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SCIENTIFIC AMERICAN

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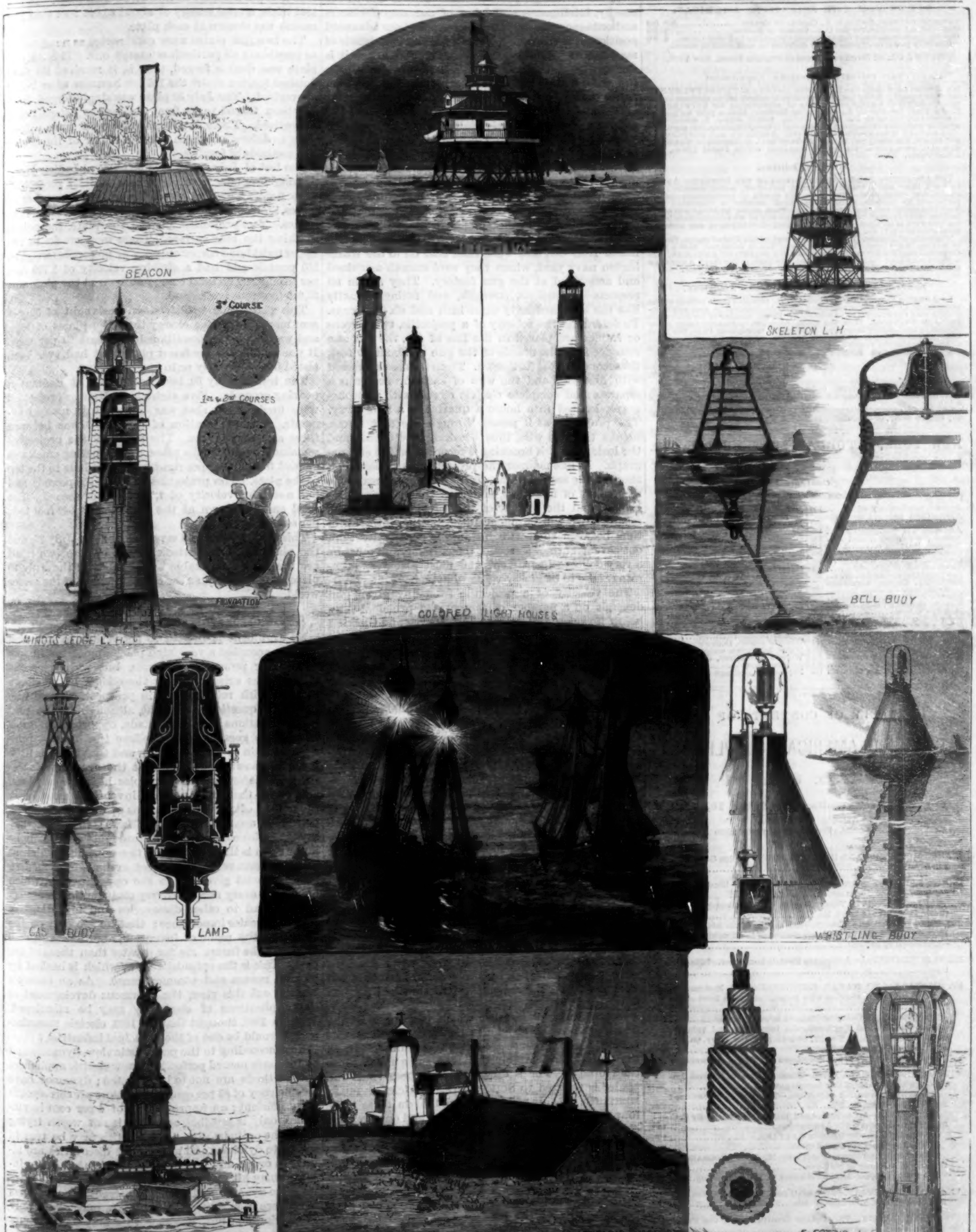

MODERN LIGHTHOUSES, LIGHTSHIPS, BUOYS, ETC.—[See p. 164.]

Scientific American.

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Contents.

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 871.

For the Week Ending September 10, 1892.

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RECENT ARMOR PLATE TRIALS.

Much has appeared of late, in the daily press, about an armor plate trial which took place at Indian Head proving grounds, on July 23, 1892, and about one which took place at Redington proving grounds, on July 30, 1892. As most of what has been said about these trials is inaccurate, and some of it absolutely incorrect, we have taken the trouble to investigate, and now place before our readers the facts as far as it is possible to obtain them.

It must be remembered that the development of armor in this country has advanced with tremendous strides, and we are now in an assured position far in advance of foreign governments. This is due to the energy, intelligence, and labor of our manufacturers and ordnance officers. In consequence of our advanced position, it is wise and desirable that certain details of manufacture should be kept secret, and hence it is difficult to obtain correct, and impossible to obtain full, information concerning our armor plates from either the government officers or the manufacturers.

The average person knows nothing of it, and the scientific engineer scarcely realizes what an exact science modern ordnance and gunnery is. As an illustration let us cite the following: The Bethlehem Iron Co. have recently equipped a proving ground, or experimental battery or testing range, at Redington, Pa., about six miles below Bethlehem, on the Lehigh River. Two navy guns were mounted there, one of eight inches caliber, the other of six inches caliber. The rough forgings for these guns were made by the Bethlehem Iron Co., and were then sent on to the Washington navy yard, where they were smooth-machined and assembled at the gun factory. They are in all respects—dimensions, strength, and fittings—exactly like the standard navy eight inch and six inch guns. To determine the velocity of a projectile, two screens or frames are placed in the line of fire, the first at a distance from the muzzle of the gun of about 70 feet, the second 100 feet further on. These frames are crossed with fine wire, and the wire of each frame forms a separate and complete electric circuit with a chronograph located in a house a quarter of a mile away. The projectile, as it passes through the first frame, breaks the fine wire, thus breaking the circuit, and the instant of this breaking is recorded on the chronograph. In like manner the projectile, as it passes on through the second frame, 100 feet distant, breaks the second set of fine wires, and thus that circuit is also broken, and the instant of this breaking is likewise recorded by the chronograph. As the interval of time between these two instants is usually less than one-seventeenth of a second, the chronograph must be a very delicate instrument and must give very accurate results to be of any value whatever.

The velocity of a projectile from any given gun depends on a number of factors, the principal ones being, however, the weight of the charge and the kind of powder used. In firing the first shot from the eight inch gun at Redington, it was desired to get a velocity 1,715 feet per second.

The gentleman in charge of the Redington experiments, who, by the way, is an ex-officer of the navy and has an excellent reputation as an ordnance expert, calculated the amount of powder of a certain grade or quality necessary to give the above velocity. The powder used was brown prismatic, and the chronographs were of the Boulenger pattern. The gun was loaded and fired, and the chronograph gave an observed velocity of 1,702 feet per second. Here was a result within less than eight-tenths of one per cent of the calculated result. An error of less than a hundredth of a second in the record of the chronograph, a few ounces more or less in the weight of the projectile or the powder charge, a few thousandths of an inch variation in the diameter of the projectile, any one of these would account for the difference between the observed and calculated velocity of the projectile. This one example would warrant us in calling the science of gunnery an exact science. This was the first shot fired, and greater exactness was obtained in succeeding shots, because the different parts could be more neatly adjusted by the information obtained from preceding shots, but the first shot had no such advantage.

In the armor plate trials which took place at the Annapolis proving ground in September, 1890, and at Indian Head proving ground in November, 1891, all the plates were severely damaged, some much more than others. For a description of these trials the reader is referred to SCIENTIFIC AMERICAN SUPPLEMENT, No. 837. It will be noticed that in these trials four projectiles from the six inch gun and one from the eight inch gun were fired at each plate. The six inch projectiles weighed 100 pounds and had a striking velocity of 2,075 feet per second. The eight inch projectiles weighed 250 pounds and had a striking velocity of 1,700 feet per second. Total amount of energy thrown at each plate, 16,940 foot tons per second.

The results of the trial of 1890 caused the navy department to abandon for the present the idea of making compound plates, and devote its energies to the development of the steel and nickel-steel plates. The trials of 1891 showed the superiority of the alloy plates of nickel-steel over the simple steel plates, and gave a strong hint of the value of surface carbonization by the Harvey or some similar process.

The manufacture and experiments with nickel-steel harveyized plates went on, every detail of the process being watched with the utmost care, and minor improvements and suggestions in the detail of manufacture were experimented with. Nothing was left undone or untried that experience and ingenuity could suggest. In all the trials the plates were of the uniform dimensions of 8 feet by 6 feet by 10½ inches. In the 1890 and 1891 trials, a total energy of about 16,940 foot tons per second was thrown at each plate. In the 1892 trials, a total energy of about 25,042 foot tons per second was thrown at each plate.

The two 1892 plates were constructed as nearly alike as possible in all particulars except one. The July 23 plate was double forged, that is, it received its final finished forging under the 125 ton hammer after being harveyized. The July 30 plate was single forged, having been forged to its final dimensions before being harveyized. These last two tests were made principally to determine which was the better of the above two methods of forging.

The test of July 23, 1892, took place at Indian Head proving ground. Five eight inch Holtzer projectiles were fired. Three of them broke into a number of pieces, and the penetration was between three and four inches. Two projectiles pierced the plate, the points reaching the rear surface. There were cracks in the upper right hand corner only. The projectiles weighed 250 pounds and had a striking velocity of 1,700 feet per second. The total energy thrown at the plate was 25,040 foot tons per second.

This plate then withstood an onslaught of 50 per cent more destructive energy than the plates of 1891, and was in a better condition by at least 20 per cent. It was by all odds the finest plate that had ever been tested in this country or in any other.

The test of July 30, 1892, took place at Redington proving grounds. Five eight inch Holtzer projectiles were fired. Each shot was broken into many fragments. The penetration of each shot was between three and four inches. The points of the projectiles remained welded in the plate. A tempering crack was opened from the upper right hand shot hole to the top of the plate. The projectiles weighed 250 pounds and had a striking velocity of 1,700 feet per second. The total energy thrown at the plate was 25,042 foot tons per second.

This trial was fully as severe as that of July 23, and the plate stood the attack better. These two trials are the most remarkable ever held, and the July 30 plate stands, to-day, as the record breaker of the armor world.

OPPORTUNITIES FOR INVENTION.

No argument is needed to show that to invention must be accorded a very high place among instrumentalities for promoting progress, but with some the question has arisen whether the climax has not been reached, with retrogression in prospect. Those who raise this question hold that, although in the past great inventions have been made, opportunities grow less as time goes on. They believe that no new principles remain to be discovered, and that there is little if any unknown material; that the greatest adaptations of materials and principles have already been made, and that from now on, inventions must be in the nature of new combinations of old materials and principles according to known laws; therefore, they say, great inventions in the future must necessarily be few. Such is the argument of the pessimist, which at first may seem rational, but seen in the light of modern progress must give way to the opposite view, which holds that every new discovery or invention is almost sure to lead to other discoveries and inventions of equal or greater importance; that we are only on the borders of the realm of invention, and that the possibilities of the future are far greater than those of the past. This is the optimist's view, which is backed by history, reason and common sense. As an example bearing out this view, the enormous development of the applications of electricity may be mentioned. Who, in 1882, thought that, in 1892, electric manufacturing would be one of the principal industries?

Now, according to the pessimistic view, dynamos and motors have neared perfection; new electric appliances and methods are not to be expected; dynamos have an efficiency of 96 per cent, and motors are correspondingly efficient; an improvement of 4 per cent in efficiency only is possible, and that is not worth trying for. The optimist says, although this may be true in regard to dynamos and motors, yet discoveries are always in order, and it is not impossible that some inventor may hit upon a new principle which will revolutionize dynamo and motor construction; what has heretofore been regarded as ultimate may prove only the beginning; but, however this may be, dynamos and motors are not prime movers. The great thing to be expected in the electrical line is an invention which will make electricity a prime mover. This is not a

new suggestion, but, nevertheless, here is a standing offer of both fortune and fame to the lucky inventor who produces the invention, either by one brilliant flash of the intellect or by years of hard work.

The thermo-electric battery, Edison's pyro-magnetic motor, and similar devices, are distant relatives of the coming electric invention. Heat energy will be put into the machine and electrical energy will be taken out. Possibly another form may be based on chemical action.

As the world grows older the gifts of nature are held in higher esteem, and thoughts of economy of material and energy become rife. Now, although our coal supply seems sufficient to outlast the race, the supply of coal to the consumer is often controlled by causes other than its scarcity, so that not only does the economization of coal afford a field for invention, but a substitute for it is to be looked for. Although water contains the required elements, the chemist tells us that to utilize water as fuel uses up more energy than can be realized from the consumption of the oxygen and hydrogen obtained by its decomposition, and while, the pessimist says, the chemist is right, and the thing is practically impossible, the other view of the subject is that it is by attempting apparently impossible things that progress is made.

If coal mining should cease, all industries need not fail for lack of power; there is power enough in the rivers and streams, in the tides and in the wind to run all the machinery in the country, if it could be properly stored and distributed. According to the optimist there are great possibilities in all these forces, and although no thoroughly practical way of utilizing these powers in a manner to compete with steam has been invented, the field is open and there is promise in it. Those differing from this view hold that while some of these powers may be used to supply a portion of the demand, others are too irregular and too unreliable to be available; and storage and distribution is too expensive to compete with steam.

There are of course two sides to these questions, but success lies in following the lines of progress. The modern inventor must be alert and must keep in mind the fact that a slight suggestion is sometimes worth thousands of dollars. How many such suggestions are overlooked it would be impossible to say, but, without doubt, for every valuable suggestion or hint or thought entertained and made use of, a score or more are allowed to pass unnoticed.

Learning a Business.

A gentleman who had induced a large publishing house to take his son, as boy, into its employ at a moderate rate of pay, not long since, was especially anxious in his request that the young man should be made to work and learn the business.

This instruction was needless, as although modern fashion has done away with much of the janitor and porterage work of old times, yet the young man found the selection of stock for orders, packing the same, entering, charging ditto, and occasional errands kept him actively employed for about ten hours a day, with an hour out for dinner.

At the end of three weeks' time he failed to put in an appearance, but the father walked in one morning with the information that John would not return to the position.

"Why not?" asked the publisher.

"Well, John has to have his breakfast at half-past seven every morning to get here, and then he is not used to carrying bundles, and sometimes he's been sent with books right up to the houses of people we know socially. My son hasn't been brought up that way, and I guess I won't have him learn this business."

He did not; and what's more, has never learned any other business.

Now let us look at another actual picture, that of the son of a wealthy mill owner desiring to become a manager of the mills.

"But that is impossible," said the father, "unless you practically learn the business."

"That is what I would like to do," said the son.

"But to become a superintendent or manager, we prefer a man who has risen from the ranks and understands the mechanical department and the ways of employes."

"Let me begin in 'the ranks,' then," replied the young man.

To this the father assented, stipulating that no favor should be shown the son, but he should actually begin and work at regular labor in the mechanical department.

Not only was this done, but the young man went and boarded in the manufacturing town at a workman's boarding house, and went in and out of the factory at bell call. In three years he was foreman in one of the departments, and a former classmate and well known society man, calling there upon him, was surprised at meeting a stalwart fellow in blue overalls, with hands so soiled with machinery oil as to prevent the conventional hand shake.

But this young man persevered, made and paid his own way himself, and his father concluded it would not injure his future prospects. Judging from the fact that he is now manager of mills (not his father's), at a salary of ten thousand a year, and with ability to command even better compensation and partnership, is evidence that "learning a business," even by a man with a good education and a rich father, pays a good return, both in money and manly independence.—*Boston Com. Bulletin.*

The World's Columbian Exposition—Official Dedicatory Ceremonies.

The programme of the dedicatory ceremonies of the World's Fair has been completed. It is subject to approval by the Council of Administration, but it is not thought many changes will be made in the arrangements.

The celebration will be inaugurated Wednesday evening, October 19, by a reception to the President of the United States, his Cabinet, and other distinguished guests at the Auditorium. The next day, Thursday, the civic celebration will occur, beginning with an imposing procession indicative of peace, contentment, and prosperity, participated in by innumerable civic organizations. The procession will be reviewed by the President, his Cabinet, Members of Congress, and other honored guests. In the evening, at Jackson Park, amid myriads of electric lights and other displays, a water pageant, "The Procession of the Centuries," will move through the waterways of the exposition grounds.

ALL THE AGES REPRESENTED.

The vessels upon which the tableaux will be presented will be modeled after those of the age represented, and the subjects are to be as follows:

1. Aboriginal age, representing the American Indians.
2. The stone age, representing the cliff dwellers.
3. The age of metal, representing the Aztecs, their religious rites, manners, and customs.
4. Columbus at the Court of Ferdinand and Isabella.
5. Departure of Columbus from Palos.
6. Discovery of America.
7. Columbus before the Court of Ferdinand and Isabella, presenting natives and the strange products of the new country.
8. English cavaliers and the settlement of Jamestown.
9. Hendrik Hudson; discovery of the Hudson River; Dutch settlement of New Amsterdam.
10. Landing of the Pilgrims and illustrations of early Puritan life.
11. Ferdinand de Soto; discovery of the Mississippi River.
12. The French explorers; Pere Marquette; Chevalier La Salle and the Northwest.
13. Washington and his Generals.
14. Signing the Declaration of Independence.
15. Union of the Colonies; the thirteen original States; the sisterhood of the great Republic; welcoming the Territories to the constellation of the States.
16. "Westward the course of empire takes it way."
17. The genius of invention; application of steam, etc.
18. Electricity and electrical appliances.
19. War, representing valor, sacrifice, power, death, devastation.
20. Peace, representing tranquillity, security, prosperity, happiness.
21. Agriculture.
22. Mining.
23. Science, art and literature.
24. The universal brotherhood of man; equal rights; law of justice; Liberty enlightening the world.

DEDICATION DAY CEREMONIES.

Friday, October 21, the national salute at sunrise will inaugurate the ceremonies of dedication day.

The President of the United States, his Cabinet, members of the Supreme Court, members of the Senate and House of Representatives, distinguished foreign guests, and Governors of the different States and Territories, with their official staffs, will be escorted by a guard of honor composed of troops of the United States Army, detachments from the various State National Guards, to the Manufactures and Liberal Arts Building, in which the dedicatory exercises will be held.

At 1 o'clock in the afternoon in this building the following dedicatory programme will be carried out under the direction of the Director General:

1. "Columbian March," written for the occasion, by Professor John K. Paine.
2. Prayer by Bishop Charles H. Fowler, D.D., LL.D., of California.
3. Dedicatory ode. Words by Miss Harriet Monroe, of Chicago; music by O. W. Chadwick, of Boston.
4. Presentation of the master artists of the exposition and their completed work, by the Chief of Construction.
5. Report of the Director General to the World's Columbian Commission.
6. Presentation of the buildings for dedication by the President of the World's Columbian Exposition to the President of the World's Columbian Commission.
7. Chorus. "The Heavens are Telling," Haydn.
8. Presentation of the buildings for dedication by the President of the World's Columbian Commission to the President of the United States.
9. Chorus, "In Praise of God," Beethoven.
10. Dedication of the buildings by the President of the United States.
11. Hallelujah Chorus from "The Messiah," Handel.
12. Dedicatory oration, the Hon. William C. P. Breckinridge, Kentucky.
13. "The Star Spangled Banner" and "Hail, Columbia," with full chorus and orchestra accompaniment.
14. Columbian oration, Chauncey M. Depew, New York.
15. National salute.

At the close of this programme a special electric and pyrotechnic display will be given, with a repetition of "The Procession of Centuries."

A series of military maneuvers and parades will constitute the main portion of the programme Saturday, Oct. 22. In the evening attractive and appropriate celebrations will be provided, followed by a magnificent display of fireworks. Pyrotechnic displays are scheduled for each of the evenings of the celebration, and they are expected far to surpass anything ever before attempted in that line.

A number of brilliant social entertainments will be given by the citizens of Chicago during the three evenings of the dedicatory ceremonies.

Drainage of the Zuyder Zee.

The commercial and technical societies of Holland have petitioned the government to advance the work upon the draining of the Zuyder Zee as fast as possible. The estimated cost of the work is $76,000,000. It requires the erection of a dike 26 feet high and 25 miles long, and involves the removal and reconstruction of the coast defenses. The plan to drain the Zuyder Zee is not new. It was proposed by Engineer Van Diggelen in 1849, before the great work of draining the Haarlem Zee was completed. It was then rejected as impracticable, but it was again proposed in 1865, and plans for the work made by Mr. Beyerinch, who had conducted the drainage of the Haarlem Zee. The result was satisfactory and the plans seemed practicable. In 1873 the Minister of the Interior appointed a committee of experts to examine into the feasibility of the plan. This committee declared it not only possible but desirable. In 1875 the Dutch Chamber voted the equivalent of $47,000,000 for the work, but nothing was then done. A solid, broad foundation has now been laid, extending from the north point of North Holland across to the island of Wieringen, and thence straight across the Zee to the nearest point of the opposite coast of Friesland, a distance of 18 miles only. It has been found that as the work advances, the sea itself assists by depositing large quantities of sand and silt at every tide, on both the outside and inside of the dam, which is being gradually, simultaneously, raised along its whole length.

When the project of draining the Zee took shape 40 years ago, the first idea was to join by dams the great islands of the Texel, Vlieland, Terschelling, and Ameland to each other and to the mainland at each end. The total length of dams required for this would have been only the same as that from Wieringen to the Friesland coast, and it would have reclaimed from the sea about half as much again as the present plan; but the tide going in and out through these openings four times daily, with tremendous strength and in enormous volume, could not be coped with. It had hollowed out deep channels between the islands, from which it was considered vain to attempt to dislodge it. It is well established by history that the Zuyder Zee was once dry land, and that the sea broke over it about 1282. The water in many places is shallow, only 4 feet and 5 feet deep. It is practically an inland sea, which at one time covered an area of 12,000 square miles, but about 400 square miles of this have been reclaimed, and the work projected anticipates reclaiming the remainder. The drainage of the Haarlem Zee, begun in 1839 and completed in 1853, reclaimed about 70 square miles, and this now sustains over 7,000 persons.

A New Hair Dye.

Silver salts have so long held the field as a hair dye that some interest attaches to the German proposal to use paraphenyldiamine for the same purpose. The invention is protected by patent, and the details as revealed by specification are somewhat wanting in clearness. From this it appears that the hair is first well brushed with a solution of 20 grammes paraphenyldiamine and 14 grammes caustic soda in a liter of water, and then washed with a 3 per cent solution of hydrogen peroxide. In the course of a day the hair becomes very dark and, by repeating the application, of a blue-black color, but if "a 5 per cent iron oxide solution" is added to the hydrogen peroxide, the color produced is brown.

AN IMPROVED WINDOW SCREEN.

The illustration represents a simple and very effective form of window screen, patented by Mr. Henry B. Dodge. The screen frame has rabbeted sides sliding in grooved ways in the sides of the window frame, as shown in the small sectional view, one of these grooved ways being made deeper than the other. A plate

DODGE'S WINDOW SCREEN.

spring attached to one side upright of the frame bears against the back wall of the deeper groove, to hold the screen in any position in which it may be placed, while permitting it to be freely moved up and down as desired, and facilitating its ready insertion and removal. Attached to the depressed portion of the same rabbet, facing the inner side wall of the grooved way, is a smaller supplemental side spring or spring guard, closing the depressed portion of the rabbet, and preventing flies, mosquitoes, or other insects from getting into the room. The screen may be made of wire cloth or netting, and is thus rendered perfectly tight-fitting.

Further information relative to this improvement may be obtained of the Monroe Manufacturing Co., Lima, O.

EXPERIMENTS WITH SOAP BUBBLES.

In addition to the scientific experiments on the superficial tension of liquids, capillary pressure, etc., to which soap bubbles lend themselves, they may be the object of various pastimes, a certain number of which have already been published in *Les Recreations Scientifiques* by Gaston Tissandier. I shall now point out three others that our readers may repeat and modify to their taste.

The liquid that I use, with one-third of glycerine, is a solution of oleate of soda. This permits of obtaining very large bubbles containing as much as 180 cubic inches of air, and which, with more limited dimensions, last for a period varying from half an hour to an hour or more if they are protected against currents of air. Ordinary soap water gives but imperfect results.

As our first experiment with bubbles necessitates the construction of a small rotary apparatus of straw (Fig. 1), we shall give directions for manufacturing it. Take a rye straw 18 inches in length, very straight and free from knots, and bend it four times at right angles, so as to obtain a rectangle 2 inches in width by $6\frac{1}{4}$ in length. As the perimeter is $2 \times 6\frac{1}{4} + 2 + 2 = 17$ inches, there remains at the smaller extremity of the straw a length of one inch, which must be inserted into the wider extremity, so as to obtain a closed rectangle. In the same way, construct a second rectangle $6\frac{1}{4}$ inches in length, but twice the thickness of the straw, say $\frac{1}{16}$ inch, wider than the preceding. Then construct a third rectangle $6\frac{1}{4}$ inches in length by $1\frac{3}{4}$ inches in width. Place the narrowest rectangle in the interior of the first, the widest outside, and arrange them upon a table in such a way that they shall make between them six angles of 60 degrees each, like the radii of the regular hexagon inscribed in a circumference. They will constitute what we shall call the wheel of the apparatus. A horizontal rectangle of straw $6\frac{1}{4}$ inches in length by $3\frac{3}{4}$ in width will furnish us with a base. At the center of the long sides of this, fix with sealing wax the bases of two uprights 10 inches in height, connected at the upper part by a cross piece 3 inches in width. Consolidate this assemblage of uprights and base by means of four braces, two on each side, 4 inches in length, the extremities of which are to be fixed in slits made in the straw with a penknife.

By means of a red hot fine wire pierce the uprights at 6 inches from the bottom, and in the same way pierce the centers of the long sides of the rectangles of the wheel, and pass a wire bent at one of its extremities into the form of a winch through the uprights and the axis of the wheel. Fix the radii of the wheel to each other near the axis with sealing wax, and also fix them to the wire axis with the same substance.

In order to increase its solidity, the base may be fixed to cardboard by means of fine wire. A hook fixed to one of the extremities of the cardboard will permit of suspending the base vertically from a wall instead of laying it upon a table.

The straw apparatus being finished, it remains for us to speak of the disks that are to serve to suspend the bubbles. These disks, cut from a visiting card, should have a diameter about that of a ten cent piece. Each of them must be suspended by its center from a cross piece of the wheel by means of a very fine wire surrounding the cross piece after the manner of a ring, and then bent in such a way as to form a suspension rod, which passes through a hole in the center of the disk and is fixed to the latter by means of a drop of sealing wax. Our figure shows very clearly that in order to keep the ring, and consequently the disk, in the center of the cross piece, the straw is traversed on each side of the ring by two wire pins, which prevent all lateral displacement of the disk. As the diameter of the rings is greater than that of the straw, the weight of the disks suffices to keep the suspension wires vertical during the revolution of the wheel.

The apparatus being thus constructed, we have only to blow small bubbles about $1\frac{1}{4}$ in. in diameter and suspend them from the lower surface of the disks, which have been previously moistened with the liquid.

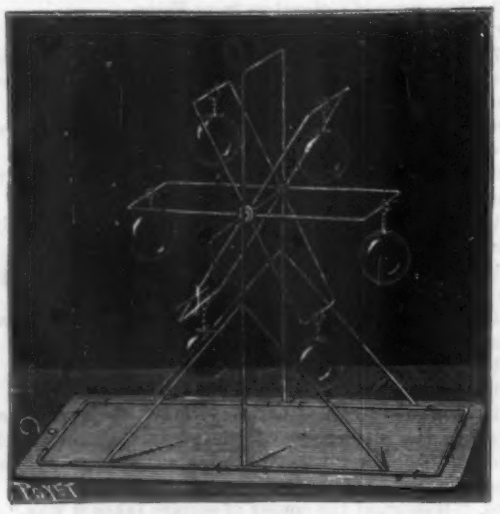
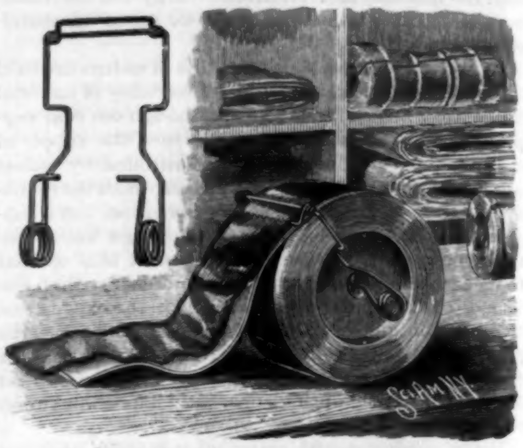


Fig. 1.—ROTARY APPARATUS OF STRAW.

The bubbles will remain suspended, and, when the wheel is turned, the pretty spheres with iridescent colors will follow it in its rotary motion. Nothing could be more elegant than this little apparatus, which I recommend to lovers of delicate work.

For those who desire something simpler, I shall describe a method of imitating an incandescent lamp, in which the globe is nothing else than a soap bubble (Fig. 2).

Take one of those porcelain flowers (a bindweed, for example) that can now be procured anywhere, and, by means of sealing wax, fasten in the interior of it a fine iron or copper wire, bent so as to imitate the filament of an incandescent lamp. Dip this wire and the edge of the flower in the liquid, and then blow a bubble $2\frac{1}{4}$ inches in diameter that the wire will penetrate and that will adhere to the contours of the flower. We shall thus have a reproduction of an incandescent lamp, which, suspended from a hook in the wall, will imitate a parlor lamp, and, placed in a small candlestick, will reproduce the inverted lamp used in offices.



AN IMPROVED RIBBON HOLDER.

Finally, here is an experiment that will greatly please young people, and that may be called fumigation or the vapor bath (Fig. 3). In a glass vessel, such as shown in the figure, place a small statuette, a bather made of porcelain, for example, after having moistened the entire body with the saponaceous liquid. Moisten the edges of the vessel likewise, and blow a large bubble, which, descending along the figure, will fix itself upon the circumference of the vessel and surround the figure. With this arrangement children may be amused by representing to them a mimic vapor bath. Moisten the extremity of the straw that has served to blow the bubble, and apply it against the latter and inject tobacco smoke into it. The statuette will disappear in the cloud thus formed around it. Pretending that the bather complains that her head is too hot, gently suck through the straw a portion of the air that the bubble contains until the latter diminishes sufficiently in volume to allow the head to appear externally, all the rest of the body remaining exposed to the beneficent fumigation.—*A. Good, in La Nature.*

Fig. 2.—IMITATION INCANDESCENT LAMPS.

Fig. 3.—IMITATION VAPOR BATH.

A CONVENIENT RIBBON HOLDER.

The illustration represents a simple and inexpensive device adapted to be secured to the spool of a roll of ribbon, braid, or similar goods, to hold the ribbon with an even tension, and guide it that it may be rewound as evenly as at first. This invention has been patented by Mr. George H. Brown. The spool is made with end recesses, in which lie the body of the holder and springs, whereby the spools may be readily piled one upon another, or arranged in the same way as ordinary spools. The device is made of wire, and is shown detached from the spool in the small view, the ends of the wire having bearings at the spool axis, and the spring portions being sufficiently strong to cause the part which presses against the face of the spool to bear thereon continuously with nearly an equal tension as the ribbon or other fabric is unwound. A guide attachment, to facilitate the rewinding of ribbon upon the spool, is secured by its coiled ends upon the outer face of the holder, this supplementary keeper being also spring-pressed.

This improvement has been patented in the United States and in England, France, and Germany, and further particulars in relation thereto may be obtained of Mr. James H. Tibbits, No. 213 Temple Street, Astoria, Long Island, N. Y.

DR. REDARD, of Geneva, uses chloride of ethyl in producing local anæsthesia by refrigeration. It is a colorless liquid of an agreeable odor, and is contained in a sealed tube of glass. When the point of the tube is broken off with pincers, the liquid is allowed to escape in a jet directed on the part to be cooled. The jet can be readily stopped by the finger or a little wax. Each tube holds ten grammes of the ethyl, a quantity sufficient for most operations. Dr. Redard has found it useful in cases of sciatica, neuralgia and toothache. The new refrigerant is likely to be serviceable in the laboratory. If the jet be directed on a tube containing water, the latter will freeze.

OLD CLOCKS.

A recent article upon an old clock has put us upon the track of various documents that appear to us to be of a nature to interest our readers. We shall publish them here without comment or pretension. Perhaps they will lead some clockmaker fond of his art to restorations of a few old mechanisms that deserve to be rescued from oblivion.

We shall in the first place describe three clocks upon which very complete details have been obligingly furnished us by Mr. T. Estreicher de Rorbierski, of Cracow, to whom we take pleasure in addressing our sincere thanks in this place.

The first clock, which is in the Jagellons Library, at Cracow, is very ancient, as shown by certain peculiarities shortly to be spoken of. We willingly believe that its inventor was actuated with the idea of rendering the sun dial independent of the caprices of our atmosphere, of making it serve at night as well as in the daytime and, in short, of making an automatic apparatus of it. It is nothing else, in fact, than a faithful and somewhat unpretentious, although very exact, representation of the apparent genesis of the hours and seasons; the sun revolving around the earth while at the same time displacing itself upon the ecliptic. This clock is represented in Fig. 1.

The meridian, mounted upon a foot, consists of two circles, one of which (the external) is stationary. The other, movable in its plane, supports the earth, to the axis of which a variable inclination may thus be given. A very light frame is fixed to this circle that carries the hours in Roman figures upon its equator, then two parallel circles representing the tropics, and, finally, twenty-four meridians. Another frame in the interior of the latter forms the support of the ecliptic. The latter is movable and is capable of revolving around the axis of the earth. It is this circle that causes the mechanism in the interior of the globe to revolve in twenty-four hours. In its rotary motion, it drives a gearing, one of the wheels of which supports the sun fixed to the extremity of a curved needle. At every revolution of the ecliptic, the gearing abuts against a finger fixed to the axis of the earth. A tooth passes, and the sun moves by one division, that is to say, by one day, upon the ecliptic, which is divided into 365 parts classified by groups under the name of the months, written in Latin.

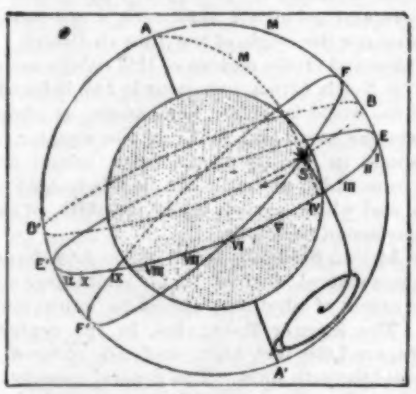


Fig. 2.—EXPLANATORY DIAGRAM.

The mechanism, which is seen with difficulty in Fig. 1, will be easily understood with the aid of the diagram in Fig. 2. M represents the initial meridian, or that of the place for which the clock has been regulated. AA is the axis of the earth. As the ecliptic, FF', revolves around the axis of the globe, the sun, S, describes a circle, BB', in 24 hours. The hour is carried back upon the equator, EE', in following a meridian, M'. The sun revolves in appearance as in nature in following the direction shown by the arrow. It is doubtless for this reason that the hours are inscribed backward (Fig. 1), in order to be read in the direction according to which they are described by this movable part. The hour that the sun indicates is that of the place situated under the meridian, M. It is midday in the meridian momentarily indicated by the sun.

The other local hours are deduced therefrom by the distance measured upon the equator between the meridian of the place and that which marks midday.

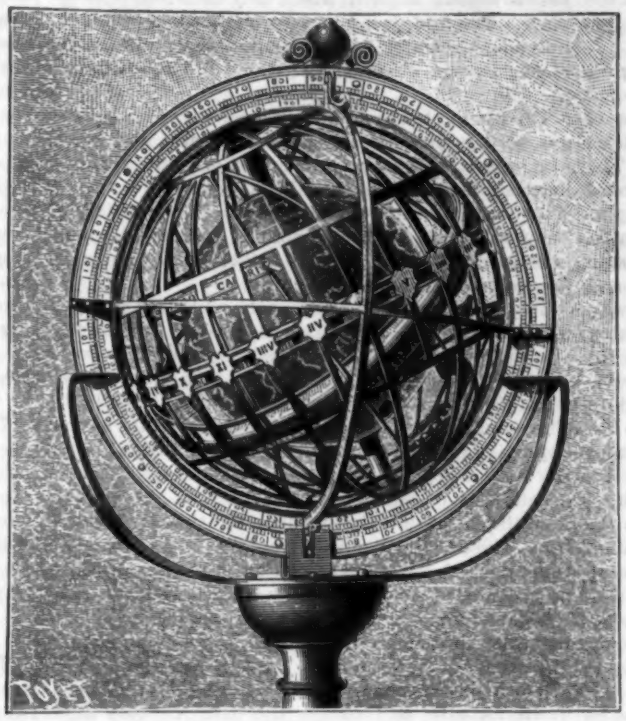


Fig. 1.—ANCIENT CLOCK IN THE JAGELLONS LIBRARY, AT CRACOW.

We can enter still further into the details of the mechanism. In Fig. 2 we have represented a small wheel which, through a pinion, actuates the polar wheel of the ecliptic. The mechanism revolving in its entirety, with the sun, in the direction B, S, B', the small wheel daily lags one tooth behind, and, acting upon the large wheel, moves the sun upon the ecliptic in the direction, S F; in other words, the sun is retarded. As, according to all appearances, it effects one revolution around the globe in one mean day, the ecliptic describes one revolution in one sidereal day, which is shorter than the other by $\frac{1}{365}$ of a day, or a little less than four minutes.

It will be seen that in this fine apparatus the solution of the problem of the hour, almost entirely copied from nature, is very complete. The mean and sidereal universal hour, the calendar, and the height of the sun at every hour and in all places, such are the data that it furnishes in a very exact manner.

What is its age? Upon this question it is difficult to pronounce, for documents are entirely wanting. It is very ancient, that goes without saying. Does it date back to the sixteenth century, as the very inaccurate manner in which America is represented might make us suppose? A large island in the Sunda group carries the inscription *America noviter reperta*, while in the location of America there is a continent quite vaguely indicated under the name of *Mondus Novus* and *Terra Sanctæ Crucis*. The waves are very crudely figured by small undulations.

The second clock (Fig. 3), though smaller, is, nevertheless, a pretty and original object of very artistic execution. It lay dismounted and in a bad condition in a barn, whence Mr. Poller, an archæologist of Cracow, obtained it. A skillful clockmaker succeeded in putting everything in place, so that it is now capable of indicating the hours again. It is a copper ball suspended from a steel chain. The hand, revolving around a vertical axis, marks the hours inscribed upon a horizontal equator. The motor is very curious. It is the clock itself that, in descending along the chain, causes the needle to revolve. The chain is wound around a horizontal axis, to which is fixed a spring like that of a watch. In measure as the clock descends, by a movement moderated by an escapement, the spring relaxes. When the clock is lifted with the two hands the spring carries the axis backward and the chain winds up anew. Upon putting the clock at the upper extremity of the chain it is rewound for twenty-four hours. A peculiar mechanism, which is controlled by means of a key, causes the striking apparatus to operate.

This clock dates back to the end of the seventeenth century. In fact, it bears the name of a very able Polish clockmaker, "Davidt-Schroter-In-Elbing." Now, Schroter lived in Elbing from 1680 to 1690, as shown by a work published at Cracow in 1888 under the title of "Insight into the Industries and Arts in Ancient Poland."

The third clock is of a more ordinary type, although it is, nevertheless, quite original. Fig. 4 suffices to allow the mechanism of it to be understood. The clock descends along a rack, and is wound like the preceding. Clocks of this form are not very rare.—*La Nature.*

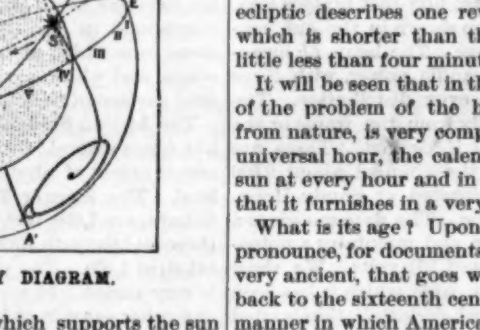


Fig. 3.—BALL CLOCK OF THE 17th CENTURY.

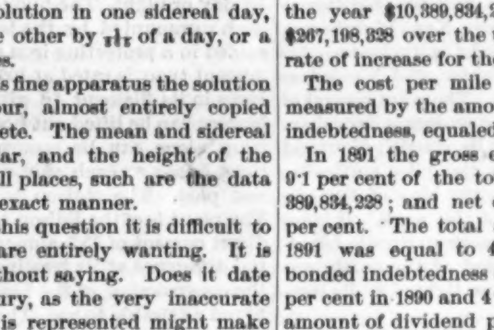


Fig. 4.—CLOCK DESCENDING ALONG A RACK.

American Railways.

According to Poor's "Manual," the total number of miles of railroad in the United States at the close of 1891 was 170,601, of which 4,471 miles were constructed during the year.

The total share capital and indebtedness of all kinds of all the roads making returns equaled at the close of the year $10,389,834,228, an increase in the year of $267,198,328 over the total of 1890 ($10,122,635,900), the rate of increase for the year being 2·6 per cent.

The cost per mile of all roads making return, as measured by the amount of their stocks and bonded indebtedness, equaled $59,820, against $59,577 for 1890.

In 1891 the gross earnings of $1,138,024,459 equaled 9·1 per cent of the total investment, aggregating $10,389,834,228; and net earnings, $356,209,880, equaled 3·1 per cent. The total amount of interest payments in 1891 was equal to 4·25 per cent of the aggregate bonded indebtedness of all companies, as against 4·27 per cent in 1890 and 4·40 per cent in 1889; and the total amount of dividend payments was equal to 1·85 per cent on all paid-up capital stock in 1891, 1·80 per cent in 1890, and 1·81 per cent in 1889.

During the period for which a large proportion of the companies reported in 1891, the business interests of the country were in a depressed condition. But the abundant crops of last year, and those now to a large extent assured for this year, would seem to predicate therefor an unusually brilliant showing.

The New Cunard Steamers.

The Cunard Company has decided, it is said, to call the new steamships, building at Fairfield, the Campania and Lucania. Campania and Lucania were the two great southern provinces of ancient Italy, as Umbria and Etruria were the two northern provinces. Campania was the fine province of which Naples was the capital, and included the scenery and rich country down to Pæstum, including Vesuvius, Pompeii, etc., and other favorite ancient (and modern) watering places; south of that came Lucania, stretching from sea to sea, running up to the highest points of the Apennines.

LIGHTHOUSES, LIGHTSHIPS, AND BUOYS.

In a recent issue of the SCIENTIFIC AMERICAN, we described the system of oil lamps used by the lighthouse establishment of the United States. The last developments in that department involve the universal employment of refined kerosene, the use of the particular types of oil lamps there illustrated, and of the Fresnel dioptric apparatus, sometimes for range lights supplemented by reflecting apparatus.

The structures built for the display of the lights, including lighthouses and beacons, and the additional safeguards to navigators afforded by buoys of different classes, including electric and gas lighted buoys, form an equally interesting subject. The diversity of position and surroundings and the need of absolutely distinctive characteristics for each lighthouse have given rise to much thought and ingenuity.

For small lights which are only required to be seen a few miles, the stake light or beacon is coming more into use than formerly. Our cut of a beacon shows a stake light upon the Hudson River, at Livingston Creek. Upon a crib a pole with arm is erected, and to the arm a lantern is suspended. In this type improvements have been recently inaugurated that tend to place such service on a much higher level than it has hitherto occupied. The well known tubular lamps have been used for this service. Ordinarily daily attention is required, but this can be dispensed with by the use of a supplemental oil reservoir, worked on the principle of a student's lamp. Such reservoirs holding a gallon of oil have been applied, enabling the lamp to burn for eight days without attention or extinguishment. There is also a move to substitute Fresnel lens lanterns in more important places, which would act to a degree as small lighthouses in the intensity of their light.

For shoal water stations where stake lights would be too small, trestle work is erected on the sands and on this a lighthouse station is erected. One illustration shows the Thimble Shoal Station, familiar to many visitors to Old Point Comfort. It is seen from the ships as they approach Hampton Roads. The general plan of all these stations is a platform supported by piles. Screw piles are often used. On the platform, a one-story building contains the keeper's dwelling, above whose center the light rises. They are structures favored mostly for southern waters, as they are particularly exposed to damage from floating ice. A ring of rip-rap stone work is sometimes placed around them to protect them from this danger.

In the same order comes the skeleton lighthouse proper, exemplified in Sombrero Key Lighthouse, Florida. This is a first order light, with lantern 142 feet above the surface of the water, and is rated as visible at eighteen nautical miles. There are several of this type in Florida waters resting on iron piles driven into coral rock. The details of the construction and of the care requisite in driving the piles vertically, when they were plumbed after every blow of the pile driver, indicate the difficulties of the work. It is on record that in the case of the American Shoals Lighthouse the iron work was completed at the north, was shipped, erected and the lamp was lighted at its summit in one year.

Masonry lighthouses are a more familiar and more ancient order of structure. The Minot's Ledge Lighthouse, which we illustrate, presents at high water a circular shaft rising directly out of the water, without any surrounding area. In it the keepers live, and go through the wildest storms which rage in Boston Bay. In 1847 and 1848, a lighthouse was built in this place upon wrought iron piles. Additional bracing was placed in position. In April, 1851, the whole was carried away in a storm. The last seen of it was on the night of April 16; the bell was heard a day later. This is the last known of its fate. It disappeared, leaving a few bent piles behind it. The work on the present structure began on July 1, 1855, and the difficulty of the work is shown by the fact that, in that year, but one hundred and thirty hours' work could be done on the rock. In 1860 the tower was completed. The sections illustrate the binding and interlocking of the courses of stone.

By using colored lights and flashing lights of different frequency, distinguishing characteristics are given at night. For the day, it is sometimes found useful to paint the lighthouses of distinguishing colors, so as to make them unmistakable landmarks. Cape Henry Lighthouse illustrates the use of vertical sections of color, and Morris Island Light, near Charleston, S. C., shows a lighthouse painted in broad rings or horizontal bands of color.

In connection with lighthouse stations, a view of Falkner's Island light is given, illustrating the establishment of a complete station for fog-signaling as well as for light-signaling. The building in the foreground not only serves as boiler house, but its roof is the water collector, and the rain supply is utilized for the boilers.

The floating structures include lightships and buoys. The lightships are strongly built schooners, which are anchored near dangerous shoals. In the daytime they are distinguished by disks at their mastheads. At night a powerful circle of lamps is hoisted up to a place immediately below the disk. They also carry a fog bell or whistle, for use as a fog signal. There are some twenty-three of these vessels on the Atlantic coast and one on Lake St. Clair. There are none on the Pacific coast. Relief lightships are kept in readiness to replace any ship which may be driven from her place. The low-placed hawse pipes leading out of the hull near the water line are characteristic. The name of the station is generally painted in large letters on the side.

The gas-lighted buoy with its reservoir of compressed gas, with high pressure regulator, burner, and lenticular apparatus, illustrates a method of warning to navigators which has recently been given a formidable rival in the electric-lighted buoy. The gas-lighted buoy will burn for three months without attention. It is designed for use both as a shoal water buoy and for designating channels.

Two other types of buoys are the whistling and ringing or bell buoys. The former depend on the fact that at a sufficient depth below the surface there is no wave motion. The whistling buoy has a long tube projecting far below it so as to reach or nearly reach this depth. This causes the water within the tube to occupy approximately the same level in storm or calm. When the buoy is lifted on a wave air is drawn into it, to be expelled as it sinks again. An inlet for air connects with the top of the tube and an outlet tube surmounted by a whistle also connects thereto. Otherwise it is tightly closed. When a sea is running a constant series of low-pitched whistling signals is thus produced.

The bell buoy of the type illustrated carries a fixed bell, with three nearly horizontal tubes arranged radially around its perimeter. Each contains a ball. With the least inclination one or the other ball rolls down its tube and strikes the bell. In very slight waves a constant ringing is thus kept up.

In our cut of the whistling buoy is shown the use of a fixed rudder plate to avoid danger of entanglement or fouling with the chain. This plate, acted on by the tide, keeps the buoy constantly facing toward its moorings. Without it there would be danger of the chain winding around the long tube. For the bell buoy the use of a bridle or double attachment of the chain is shown. The weight hung at its bottom for ballast is also shown.

The electric-lighted buoy now in use in the harbor of New York is also shown in the cut. It is used to define Gedney's Channel, so that ships can now enter by day or night. The buoys are fifty-foot juniper logs, each surmounted by the lamp shown in the cut, contained in a protecting iron cage. The lamp, of incandescent type, is rated at 100 candle power, with three loops in its filament to give even distribution. The lantern can be lifted out bodily from the frame or the lamp alone can be removed if desired. There are three buoys on each side of the channel, about 2,000 feet part. The station is situated at Sandy Hook. The plant is of the Edison type. The dynamo gives a direct current of 25·5 amperes and maintains a potential difference at its terminals of 160 volts. We show the construction of the heavy cable which it has been found advisable to use. The whole installation is cited as the only one of the kind in the world. By its use a channel 1,000 feet wide and 4,000 feet long is defined as clearly at night as by day.

We also illustrate the statue of Liberty in New York Harbor. The statue now carries in the torch a powerful system of electric lights. It has been proposed to so modify the distribution of light that the direct view of the light will be had from a distance only, while vessels near it will be protected from its glare. By reflectors the body of the statue proper will be lighted.

Our thanks are due for courtesies received to Commander C. H. West and Major D. P. Heap, of the United States Lighthouse establishment.

Electrical Terms.

At the present time electricity depends upon steam engineering for its generation. Therefore it behooves every live engineer to acquire all the knowledge regarding its generation and application that he possibly can. At the present time nearly all our ocean, river, and lake steamers are equipped with dynamos for electric lighting, and the engineer who does not acquire knowledge necessary to care for the dynamos and its appliances will find hard work to procure a position. Engineers will find herein the electrical terms so clearly defined that any person can easily understand them: Volt, unit of pressure, called electric motor force, same as pounds of steam; ampere, unit of quantity, called current, same as gallons of water; ohm, unit of resistance, similar to friction; watt, unit of energy consumed, similar to foot pounds, and thus 746 watts equal one horse power, same as 33,000 foot pounds.

The whole question of electrical distribution may be popularly illustrated by its analogy to hydraulics. The dynamo is essentially a rotary pump, but pumping electricity instead of water. If the discharge pipe of a rotary pump be carried around through a given circuit and connected with a suction, both pump and pipes being full of water, the movement of the pump will obviously cause the water to flow in one direction, producing a continuous current of water. Substitute dynamo for pump, wire for pipe, and electricity for water, and conception of electrical transmission by the continuous current is at once clear as to its elementary phenomena. We will bracket the analogous electrical terms; then we may say that a certain number of pounds (volts) of pressure are required to overcome the friction (resistance) of the pipe (wire) in order that the water (current) may flow at the rate of so many gallons (amperes) per minute. The larger the pipe (wire) the more water (current) can be carried and the less will be the friction (resistance); or per contra, the smaller the pipe (wire) the less the quantity (amperes) per minute and the greater the friction (resistance). Manifestly the pipe (wire) might be so small that the friction (resistance) would absorb a very large proportion of the power of the pump (dynamo), leaving but little remaining for useful effect, therefore the two horns of the dilemma are: If the pipe (wire) be too large, it will cost too much; if too small, the loss will be too great.

The electrical appliances are also analogous to engineering appliances. The switches are valves, the fusible strips are the safety valves, the contacts are the pipe fittings. If the contact is insufficient to carry the current, there will be a leak (drop) in the current. The voltmeter is the pressure gauge; the ammeter is the same as the water or gas meter, the recorder of quantity consumed.—*R. G. Davis, in Marine Review.*

The Sahara.

The Sahara is an immense zone of desert which commences on the shores of the Atlantic Ocean, between the Canaries and Cape de Verde, and traverses the whole of North Africa, Arabia, and Persia, as far as Central Asia. The Mediterranean portion of it may be said roughly to extend between the 15th and 30th degrees of north latitude.

This was popularly supposed to have been a vast inland sea in very recent times, but the theory was supported by geographical facts wrongly interpreted. It has been abundantly proved by the researches of travelers and geologists that such a sea was neither the cause nor the origin of the Libyan Desert.

Rainless and sterile regions of this nature are not peculiar to North Africa, but occur in two belts which go round the world in either hemisphere, at about similar distances north and south of the equator. These correspond in locality to the great inland drainage areas from which no water can be discharged into the ocean, and which occupy about one-fifth of the total land surface of the globe.

The African Sahara is by no means a uniform plain, but forms several distinct basins containing a considerable extent of what may almost be called mountain land. The Hoggar Mountains, in the center of the Sahara, are 7,000 feet high, and are covered during three months with snow. The general average may be taken at 1,500. The physical character of the region is very varied. In some places, such as Tiout, Touat, and other oases in or bordering on Morocco, there are well-watered valleys, with fine scenery and almost European vegetation, where the fruits of the North flourish side by side with the palm tree. In others there are rivers like the Uied Guir, an affluent of the Niger, which the French soldiers, who saw it in 1870, compared to the Loire. Again, as in the bed of the Uied Rir, there is a subterranean river which gives a sufficient supply of water to make a chain of rich and well peopled oases equal in fertility to some of the finest portions of Algeria. The greater part of Sahara, however, is hard and undulating, cut up by dry water courses, such as the Igharghar, which descends to the Chott Melghigh, and almost entirely without animal or vegetable life.

About one-sixth of its extent consists of dunes of moving sand, a vast accumulation of detritus washed down from more northern and southern regions—perhaps during the glacial epoch—but with no indication of marine formation. These are difficult and even dangerous to traverse, but they are not entirely destitute of vegetation. Water is found at rare but well known intervals, and there is an abundance of salsolaceous plants which serve as food for the camel. This sand is largely produced by wind action on the underlying rocks, and is not sterile in itself—it is only the want of water which makes it so. Wherever water does exist, or artesian wells are sunk, oases of great fertility never fail to follow.

Some parts of the Sahara are below the level of the sea, and here are formed what are called chotts or sebkhas, open depressions without any outlets, inundated by torrents from the southern slopes of the Atlas in winter and covered with a saline efflorescence in summer. This salt by no means proves the former existence of an inland sea. It is produced by the concentration of the natural salts, which exist in every variety of soil, washed down by winter rains, with which the unevaporated residue of water becomes saturated.—*Medit. Naturalist.*

The Garrison of the Human Body.

Among the topics discussed by Prince Krapotkin in an article on recent science contributed to the *Nineteenth Century*, there is one of extraordinary interest, namely, the incessant conflict going on between the micro-organisms that invade and those which defend the living body. Of all the discoveries made of late years by biologists, none is more striking than the demonstration that almost all infectious diseases may be traced to foreign bacilli, whose intrusion is resisted by a militia of resident micro-organisms known under the general name of leucocytes, the function of which is to attack, swallow, digest, neutralize, or expel the alien and noxious microbes. The outcome of this ceaseless struggle within the body is on the one hand health and life, and on the other disease and dissolution.

So far, we know more about our assailants than our defenders. Bacteriology, the branch of science which deals with the germ theory of disease, may be said to have been founded about the end of the fifties by Pasteur's researches into the fermentation of beer and wine and Virchow's investigations into cellular pathology. Since then, although some alleged discoveries have been confuted, many have been verified, and we indisputably know a great number of micro-organisms which are capable, under certain circumstances, of producing certain specific maladies. For example, cholera, typhoid fever, and gastric affections generally; malaria and influenza; tuberculosis, leprosy, and cancer; diphtheria, measles, and scarlet fever; rheumatism, smallpox, rabies, and tetanus have been traced to separate microscopical beings. The photograph of each separate bacillus may be found in the text books; its modes of life, and very often its methods of reproduction, have been carefully studied, both in the animal body and in artificial cultures; subjected also to minute scrutiny have been the morbid effects which it produces when introduced into the bodies of various animals. In a word, the germ origin of infectious diseases can no longer be described as a theory; it is a fact.

Relatively backward is our knowledge of the means of combating infectious micro-organisms. Most of the specifics which once awakened hope have proved, in the long run, as ineffective against the bacilli themselves as the specifics proposed by physicians have proved against the resultant maladies. The more the study of bacteria advances the stronger is the tendency to recognize that, as sanitary measures are the most effective precautions against the risks of infection, so a healthy body which is itself capable of checking the development of morbid micro-organisms is the best means of combating them. But what is it that permits a healthy body to resist invasion by morbid microbes? We know the invaders; but what is it that renders them highly noxious in some cases and quite inoffensive in some others? To this question cannot yet be given an answer which commands the universal assent of biologists. The broadest and most ingenious explanation of immunity thus far put forth is the theory elaborated in 1883 by Elie Menchikoff, which represents an extension of the leading principles of the struggle for life to the microscopic constituents of the animal body. There exist in the body of man, and of all vertebrates, besides the cells which constitute the animal tissues, a number of free cells, the white corpuscles of blood and lymph, and the so-called wandering cells of the tissues. Four different varieties of these free cells, collectively known as *leucocytes*, have been described, the distinctions between them being chiefly based upon the shape and the numbers of their nuclei. It appears that the leucocytes of both the higher and the lower animals have all the distinctive features of simple amœbæ. They protrude pseudopodia or feelers, and they move about, and, like amœbæ, they are endowed to a high degree with the capacity of ingesting all kinds of small granules which they find in their way, including various smaller micro-organisms. In some cases the bacilli thus ingested are *digested*, that is, transformed into a soluble matter, which is assimilated by the protoplasm of the leucocytes.

In other cases the bacteria are for some time kept alive within the leucocytes, and if the latter are placed in conditions unfavorable for themselves but favorable for the invading microbes, the invaders develop and are set free. In still other cases the leucocytes contribute to the defense of the body by driving the hostile bacteria out of the organism through the skin. Transpiration is a familiar instance of the last-named process. Investigation has also demonstrated that the efficiency of the leucocytes varies greatly in different members of the same species of animal, their vigor being proportionate to the general health of the body. If the leucocytes are vigorous, they prevent the germination of the spores which they had ingested; but they maintain this power at a maximum only so long as they are healthy. If an animal has been submitted to cold, or has been narcotized, it loses its immunity from infectious maladies.

Such are the facts, and it seems reasonable to explain them, as does Menchikoff, on the theory that the leucocytes are the defensive agencies against infectious disease with which animal bodies have been endowed by nature. The necessities of the struggle for existence have evolved in living organisms the capacity of self-protection by dispatching armies of leucocytes to the spots attacked by noxious microbes. The struggle, as we have said, may end in either the rout of the leucocytes, in which case disease ensues, or in the repulse of the microbes, which is followed by recovery. Or, again, the outcome may be a drawn battle, which represents the state of things in various chronic diseases.—*N. Y. Sun.*

Electric vs. Steam Roads.

In an article in a recent number of the *Railroad Gazette* on electric and steam traction for suburban and through lines, not car line traffic, the writer reaches the following conclusions:

1. There is no prospect of electricity replacing steam for long distance freight traffic.

2. There is a possibility of electricity becoming an economical substitute for steam locomotives for high speed service, wherever the traffic is sufficiently heavy and constant to warrant the construction of lines of track independent of those used for moderate speeds.

3. There are very few localities in the United States in which the conditions are such as to make such a substitution commercially possible, with the efficiencies at present obtained with electrical machinery.

4. If the electrical equipment could be purchased at reasonable prices, there are a few short lines of steam railroad on which the passenger traffic is such as to make electricity a possible form of motive power at present speeds.

5. It is probable the electric locomotives will be used in tunnels and for switching in cities where freedom from smoke is important.

6. No electric motor capable of doing the work of a medium weight steam locomotive has yet been constructed.

The first conclusion is evident from the fact that the cost of the conductors for the electric current and the loss on the long lines due to leakage and resistance would more than offset what might be gained in the fuel saving. The second conclusion is also evident, except that part calling for independent tracks and for high speed traffic. Why the traffic must be independent is not clear, as all that is needed is a clear track, and that can be had with slow or high speed trains. Perhaps a constant speed may be an essential condition, but it may be high or low and yet be constant. So far, the above quoted journal says, electric construction companies have been simply talking, and in that they contrast strongly with makers of other mechanical innovations, who do, as a rule, make a try at a job at least before they talk of the wonderful possibilities of their devices. But to do them justice, we should say they are working in good faith, only they prefer that some one else should pay the cost of making expensive experiments. The Baltimore and Ohio tunnel job will give them a chance to show what they can do, as the horse power required to haul the proposed trains at the proper speeds up the given grades, viz., 1,200 tons at fifteen miles an hour and 500 tons at thirty miles an hour up a 42 foot grade, is about 950. This is certainly enough to commence on.

A WRITER in *The Clay Worker* well says: "The capable man in any walk of life is rare. The capable boy is rare. It is a very difficult matter to get a good office boy or a steady, capable fellow to run an elevator in an office building. Really good laborers are scarce. We sometimes think about over-crowded professions, or an over-supply of help in many directions. The supply of really capable help of any kind is limited. A first-class superintendent of a works of any kind is very difficult to get hold of. He is rarely out of a job. A man who is out of a job is open to suspicion. The best and most capable help comes out of the workshop—the steady, quiet fellows. There are not many of them in any establishment. Generally one of good judgment can pick a leader from a gang of men. He will need a little coaching, some help and some patience. But he is nearly always to be found. When such a one is discovered, the great work has been done. A man has been lifted up from a lower plane to a higher one; his horizon has been enlarged; the world has grown bigger for him. Nevertheless, the really capable man is rare, and in this prosperous period he is seldom if ever out of a job.

Underground Telephone Wires.

In speaking of the future of the telephone, Professor A. Graham Bell says:

"The telephone, as at present constructed, needs the open air to obtain the best results. To use wires placed underground, a metallic circuit will be necessary, similar to the one used now on long distance lines. To place the wires under ground and to make a metallic circuit, which means to use two wires where one is used at present, will materially increase the expenses of the company, and the public must pay for the luxury. As the number of wires is increasing rapidly, it is evident that they must ere long be buried."

The Vanderbilt Palace in North Carolina.

Two miles out from Asheville, N. C., is a little station, Biltmore. It is the headquarters of a water tank and the gate of Kenilworth Inn. It is something more. The Salisbury and Spartanburg divisions of the Western North Carolina Railroad come together here, while a little branch road deflects to the right and is lost among the hills. If you happen to see one of the little cars on this road you will notice the letters "G. W. N. V. C." on it. The car is loaded with stone or coal, maybe iron, and you may be sure it is bound for Vanderbilt's famous building two miles away. "Biltmore" is called for Vanderbilt and a resident of the name of Moore, who has a pretty cottage on the road, just above the station. It is a smooth combination, and likely to become famous.

Following the branch road, which runs up and down hill with equal facility, and winds around the mountains, you reach, in the course of half an hour, the summit of the Long Pine. This is the busiest spot in North Carolina. You pass Vanderbilt's stone quarry, where much of the material for rougher work has been secured; you view his brick yards, where millions of tubes are pressing and baking; you stop at his blacksmith shop, where the tools are mended and some castings made; you ride near the shady home which he has purchased for his chief engineer, always following up his rails and telegraph lines, which lead to the spot where lies the site of the house of Vanderbilt.

Several years ago Vanderbilt wandered down to Buncombe County, N. C., and was attracted by the beauty of the place. He rode over the mountains, and while at the summit of Long Pine, two miles from Asheville, concluded he would buy a tract and put up a shooting lodge. This led to the purchase of a large lot of land up and down the mountain and along the French Broad, with the idea of controlling everything in sight and preventing settlers from obstructing the view or coming too close. Visions of deer park, quail covers, sheep farms, and other schemes enlarged his demesne until his acres began to be numbered by thousands. White and black settlers surrendered their lodgings at good prices, and now there are only two or three black dwellers within the Vanderbilt limits, who have refused to sell out, and hold their places at $1,000 per acre. Vanderbilt may buy them out or he may freeze them out.

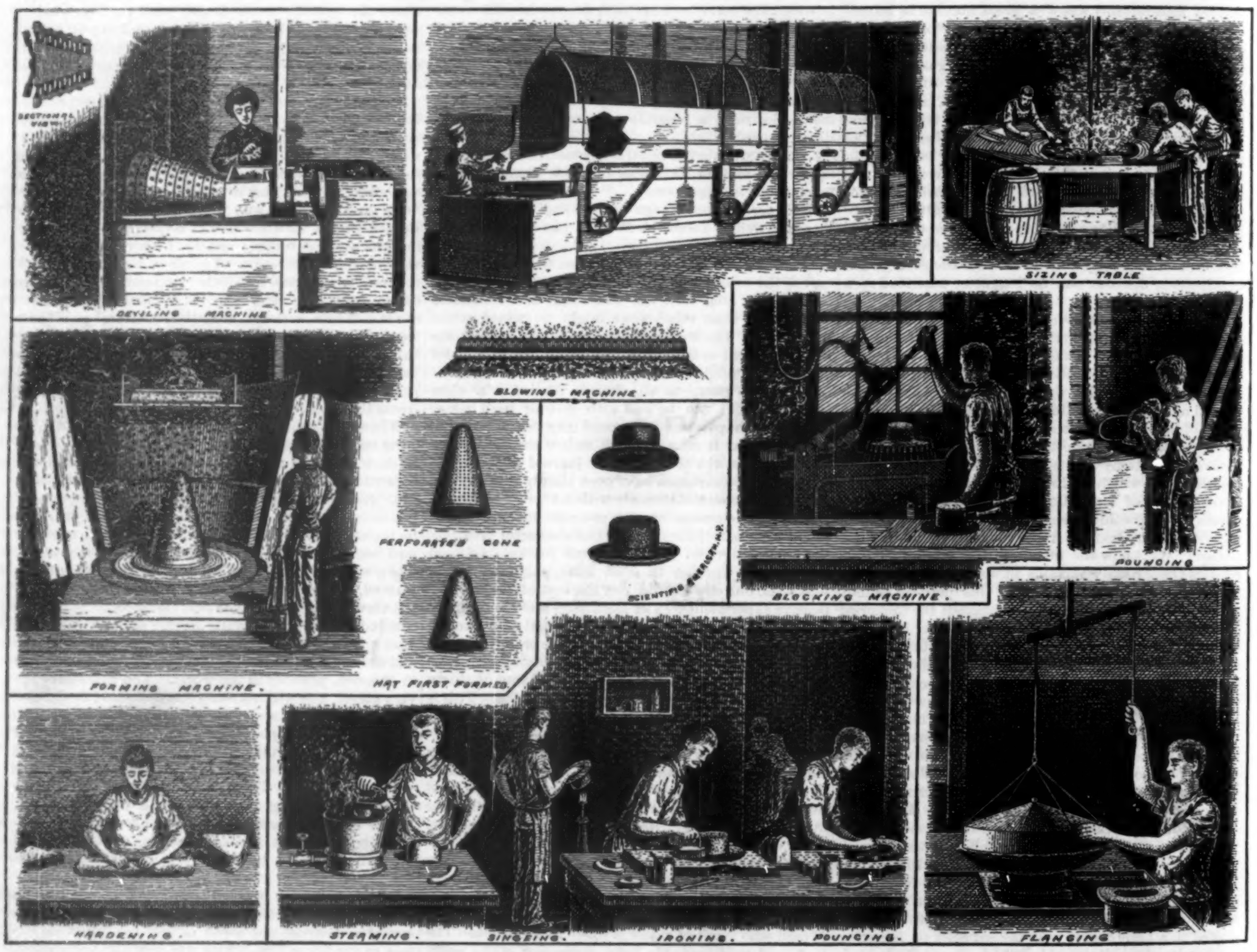
When Vanderbilt had finished his purchase of 5,000 acres his ideas broadened. Instead of a shooting lodge he decided to put up a residence, and such a residence as would make Chauncey Depew's eyes glisten at Peekskill. So he set about him and leveled off the cone of the mountain thirty feet. Some time over a year ago he began to lay his foundations, and his stone masonry now begins to rise sheer over the side of the mountain, like a walled precipice. This is just what Vanderbilt wanted, for he determined that his castle would have the view and command the heights unobstructed. He concluded to spend from his income about $1,000,000 a year for ten years, and he is pretty well assured, at the end of that time, of having the finest private residence in America, possibly in the world. The architects are very clever, but will not show the designs of the house. Perhaps they fear somebody will duplicate them before the dwelling is completed. The building will be 400 feet long and 300 feet wide. It has a tennis court in the left which is a marvel of masonry and filling, and which alone cost $10,000. The banquet hall of the mansion is to be 70 feet long, and will have a pitch of 30 feet. Under the main entrance of the hall will be a swimming pool, while a fine gymnasium, wine cellar, and art gallery are to be connected with the establishment.

Three miles back of the dwelling is a cold spring on the top of Busby Mountain. He has purchased this spring and carries the water in six iron pipes all the way to the Long Pine. This will give him volume and pressure enough for every part of his premises, and enable him to throw a stream 100 feet high from any point on his place. It will insure a dozen or more fountains in his parks and drives; 500 hands are at work on the grounds and buildings. Superb carriage ways are graded and macadamized up the mountain, commanding an approach to the house, and these will be continued beyond the residence and down the valley to the French Broad, where Vanderbilt will throw an iron bridge over this picturesque stream.

Mr. Vanderbilt is thirty-eight and unmarried. He has selected a rare spot for his home. His front garden steps right off into space and secures a view for miles of rich valleys and high-walled mountains in the distance. Pisgah and the trains of hills seem to grow opaline in the sunset and to be transparent. At the base is the French Broad, and two miles away are the spires and smoke of Asheville. To the right are the red gables of Kenilworth Inn, while directly in front, a mile or more away, are the chimneys of Oakland Sanitarium and Connell's residence. There is nothing in Virginia, nothing in England, and, I am told, nothing finer than this view in western North Carolina. This palace of marble and iron is built for all time, and the picture will be kept perfect, so far as nature and art can make it so.—*Chattanooga Times.*

MANUFACTURE OF FELT HATS.

The present illustrations were taken from the No Name Hat Works, Orange Valley, N. J. The fur that is used in manufacture of felt hats is imported from Europe. They are made of a mixture of the fur taken from such animals as the coney, nutria, hare, musk, and short seal. Formerly, the fur first went through a process called bowing. This was an instrument resembling the bow of a bass violin, about 7 ft. long, with a string of catgut stretched from end to end. This string was drawn back and forth by hand, over a quantity of fur, the vibration of which caused the fur to separate from the mass and fly to the right into a receptacle ready for the next operation. The deviling machine now in use for separating and mixing the fur is a cone-shaped cylinder, about 3 ft. in length, 2 ft. in diameter at one end and 14 in. at the other. Projecting from the underside are rows of teeth set an inch or so apart. A shaft running through the center, about the same shape as the cylinder, is also set with teeth placed in such a position that, when the machinery is set in motion, they pass between each other. These teeth are about 3 in. in length and about ¼ in. in diameter. The fur is run through the small end of cylinder, the teeth of which separate it into fine particles, and also mix the different kinds of fur thoroughly together. The fur is drawn through the cylinder by the aid of fans at the end of the shaft, and gathered up for the next operation, which is the blowing process. This machine is about 20 ft. in length and about 4 ft. in width. It separates the good from the bad fur, and takes out all of the impurities. The fur is placed on an oilcloth belt, and run through a couple of iron rollers. It is then taken up by a 3 in. wooden roller, the surface of which is covered with sharp pins. The air caused by the revolving of the roller, with the aid of the pins, blows the good and bad parts from each other. This operation is performed six times, the fur passing out of the machine almost as fine as silk. It is then weighed out and pigeonholed for the different sized hats. From here it goes to the forming machine. This machine is pail-shaped, and made mostly of hard wood. It is about 4 ft. in diameter at the top and about 3 ft. at the bottom, and about 6 ft. in height. The weighed out fur, from which a certain sized hat is to be made, is first placed on an oilcloth belt, which carries it to a brush roller, which whisks the fur over into the forming machine. The hat is formed over a perforated copper cone. These cones are of various sizes, running from 10 by 15 to 30 by 40 in., according to the size of the hat to be made. The cone is first wet and made to revolve over an orifice, under which is a powerful fan, which causes an inward draught through the perforated cone. The fur, as it is whisked over by the brush roller, is sucked down by the current of air passing through the cone, which, being wet, causes the fur to adhere to it. The cone revolves until the quantity required for the hat is run out. A wet cloth is then placed around it, to keep the stock together. A cap is placed over it, and it is taken up and placed in a tub of water. It is then taken out and off the cone and taken to be hardened. A dozen of hats is placed inside a cloth, and rolled about in the same manner a baker would form loaves of bread. This tends to shrink, and give the hat body. From here the hat goes through what is called sizing or shrinking. The sizing tables are octagonal in shape, and are made of wood. In the center of table is a copper kettle, about 3 ft. in diameter, filled with boiling water. The hats are first dipped into the scalding water, and then gently rolled with a tapering rolling pin toward the ends, and worked in every direction to toughen and shrink them and at the same time prevent the sides from sticking. Wooden gloves are also used in rubbing. The process of sizing is gone over several times. The hats are then taken and stretched and dyed. After the dyeing process, the hats are placed in a tub of boiling water. A hat is taken while it is hot, and put into a blocking machine. This machine is made mostly of movable steel bars, circular in shape, and arranged so that they can be opened and drawn together by means of levers. A hat is first drawn over a set of inner bars, which form a solid block, the shape of a hat. The outer set of bars grasps the rim of the hat by means of the lower levers. The upper one, containing the ring with the hose attachment, is drawn down over the hat, which gives it its shape. Cold water from the hose is then applied. The hat is then taken out and sent to the drying room. The rough particles and hair that stick out of the hats are then shaved off with a sharp knife. The rims of the hats are shellacked. The pouncing process is done by stretching a hat over a revolving block, the hat then being rubbed off with fine emery paper, the particles flying from the hat passing up through the draught pipe. The hats are then taken to the finishing room. They are first steamed, so that they can be stretched over a hat block, then greased, ironed and singed. They are then taken to have the binding and sweat bands sewed on, and then to the flanging room. The hat is set into a frame of the same shape, the brim ironed, and then placed on the flanging table. This table is hollow, and is made of wrought iron. It is 2½ ft. in width and 2 in. in thickness. The table is filled with steam for heating the flanging pans. These pans are 30 in. in diameter, and 12 in. in height, with a heavy muslin bottom. This pan is lowered on to the hat; the weight and the giving way of the sand cause the brim to take the same shape as the frame. The pan is left on the hat from three to eight minutes. The hat is then ready for sale. This concern employs about 150 hands, and turns out about 200 dozen fine grade hats per week.



MANUFACTURE OF FELT HATS.

Causes of Deterioration of Rubber.

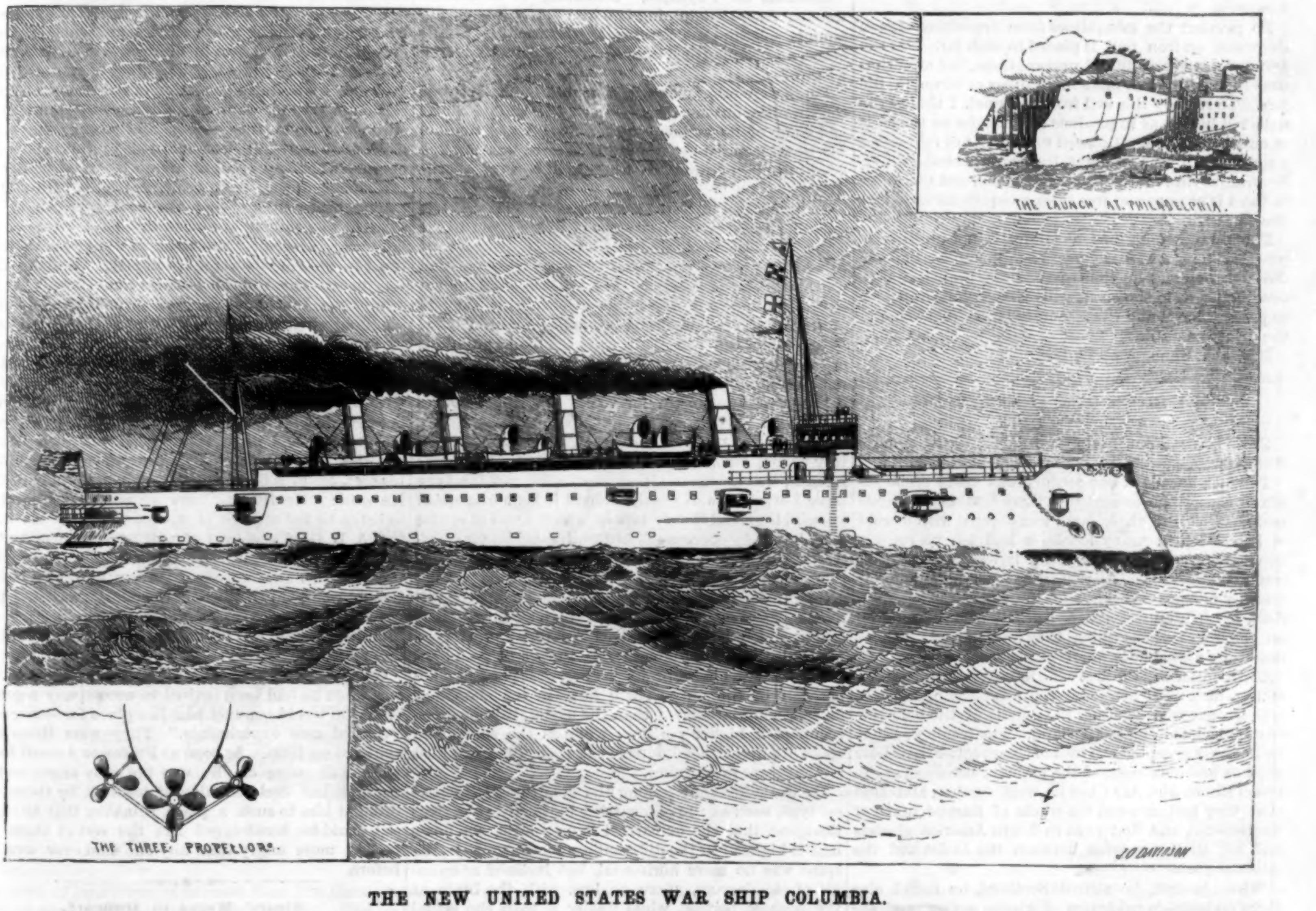
In a recent paper on the vulcanization and decay of rubber, by Mr. W. Thompson, are some statements which may throw new light on the deterioration of rubber hose used in railroad service. Copper salts have an injurious effect upon India rubber, and as such salts are sometimes used in dyeing rubber goods black, this may frequently account for their decomposition and hardening. Metallic copper in contact with rubber causes oxidation and hardening of the gum, although no appreciable amount of the metal enters into it. Zinc does not in any way affect the rubber. Oil containing even small amounts of copper coming in contact with rubber goods is highly injurious. There is also an acid in linseed oil which rots the cloth. All oils, except castor oil, exert a detrimental effect upon rubber. One of the evidences of decomposition is the evolution of a strong odor. When a piece of blotting paper is placed over decaying rubber it becomes discolored by some of the emanations, which does not occur when the rubber is in good condition.

From this it appears that volatile substances are emitted during the oxidation which produces the hardening of India rubber.

THE COLUMBIA.

The name of the fastest of the vessels of our new navy, which was launched at Philadelphia in July last, was given in honor of the capital of South Carolina, as the vessel is of a class that takes the name of a city, although Secretary Tracy thought that, on account of the near approach of the Columbus Centennial, the name might have a double significance. According to the terms of the contract under which she is being built, the Columbia must have a speed of 21 knots an hour, with a possibility of doing 22 knots. She will, to do this, have greater horse power than any vessel ever before built in America, and is, with one exception, the first large vessel ever built with triple screws. The arrangement of these screws is shown in one of the views.

She was launched with one of the three screws fixed in its place. It was the single screw at the stern of the vessel, next to the rudder. It is fifteen feet further aft than the twin screws, and much deeper in the water. The other screws will be put in position soon. There are to be three engines in the vessel, each transmitting 7,000 horse power to a screw. To put a strain of 10,500 horse power on each of two shafts would have taxed the capacity of the shafts too much, and would have made the chance of serious accidents very probable.



THE NEW UNITED STATES WAR SHIP COLUMBIA.

By having three screws the power is better distributed, and there is the additional advantage of being able to use only one screw at times of slow speed and of alternating the work of the engines on ordinary occasions. Our engraving is from *Once a Week*.

The dimensions of the Columbia, and other particulars, were given in the SCIENTIFIC AMERICAN of August 6. She is 412 feet long, 58 feet broad, draws 24 feet, has a displacement of 7,475 tons, and an indicated horse power of 21,000. Her main armament is to consist of one 8-inch gun, two 6-inch guns, four 4-inch guns, besides twenty 6-pounders and four 1-pounders in her secondary battery. She has no armor, but the protective deck over her machinery is four inches thick. Her cost price is to be $2,725,000, and her builders are to have $25,000 for each quarter knot they make over the required twenty-one knots.

Protection of Salmon in Alaska.

By the terms of an act of Congress approved March 2, 1889, it is provided: That the erection of dams, barricades, or other obstructions in any of the rivers of Alaska, with the purpose or result of preventing or impeding the ascent of salmon or other anadromous species to their spawning grounds, is hereby declared to be unlawful, and the Secretary of the Treasury is authorized and directed to establish such regulations and surveillance as may be necessary to insure that this prohibition is strictly enforced and to otherwise protect the salmon fisheries of Alaska; and every person who shall be found guilty of a violation of the provisions of this section shall be fined not less than $250 for each day of the continuance of such obstruction. The United States reserves the right to regulate the taking of salmon, and to do all things necessary to protect and prevent the destruction of salmon in all the waters of the lands granted under said act and frequented by salmon.

Forcing Vegetables by Electricity.

Electricity, a writer in the *Horticultural Times* tells us, is about to find full employment in horticulture. Spring vegetables are already being forced by its aid for the market. There is no doubt that roses and other flowers can be made to bloom more plentifully and more profitably with its assistance. In short, the discovery affords promise of possibilities not yet estimated. It has been found that lettuce is particularly susceptible to the influence of the electric light, by means of which it can be grown for market in two-thirds the usual length of time. Other vegetables respond, likewise, in varying degrees. But everything depends upon the proper regulating of the light, and how to do this can only be learned by careful study of the results produced under all sorts of conditions. The effects of electricity being to hasten maturity, too much of it causes lettuce to run to seed before the edible leaves are formed.

It must not be imagined that electricity is employed for such purposes as a substitute for sunlight. It is merely used in a supplementary fashion. The greenhouse that has the sun in the daytime is illuminated at night with arc lights, toward which the plants incline their leaves and flowers, accepting quite innocently these artificial counterfeits of the orb of day. It was supposed hitherto that vegetables required intervals of darkness for their health and development, just as animals need sleep, but it has been shown that, supplied with electric rays, they will go on growing thriftily between sunset and daybreak; staying up all night seems to do them no harm, so long as the dissipation is properly regulated. The electric gardener employs opal globes to diminish the intensity of the light. When it is left bare and admitted to shed its unfiltered rays upon the plants, the latter grow pale, run up quickly in sticky stalks, and soon die. It remains to be discovered exactly how much electricity is beneficial, and during precisely what period of the development it ought to be applied. The influence of electricity upon the color and productiveness has been shown to be extraordinary. Tulips exposed to its light have deeper and richer tints, flowering more freely, and developing longer stems and bigger leaves. Fuchsias bloom earlier under like conditions. Petunias also bloom earlier and more profusely, growing taller and more slender. It is the same way with many other flowers. In fact, there is every reason for believing that the electric light will be very profitably used in future as an adjunct to forcing establishments for both flowers and garden vegetables.

Florida Oranges and Other Fruits for England.

Steamers have been chartered to take Florida oranges to England early in October next. It is expected that this fruit will reach England before the Mediterranean supplies come in.

For carrying fruit from Australia and South Africa, refrigerated holds are required, and experimental shipments from those countries have been so successful that fruit culture for London consumption is likely to be a growing industry in both Australia and Africa. As to the future, Mr. Creighton, of Victoria, in the Australian *Garden and Field*, says: "The United Kingdom's imports of fruit amount to nearly $35,000,000 annually, and I am quite sure that Australia would be able, in time, to get a good share of that trade. Something has been done in Victoria and Tasmania in the way of sending fresh fruit to the United Kingdom, apples and pears having been sent from both colonies with good success, and satisfactory prices realized. The quantity of apples imported into the United Kingdom amounts to about 6,000,000 bushels, and about half that quantity of pears. Australia has peculiar advantages, owing to the difference of the season, and would be able to put fruit on the London market at a time when the supplies of Europe and America are practically exhausted, thus getting almost a monopoly of the London market during that period."

A Great Search Light on Mount Washington.

There has recently been placed on the summit of Mt. Washington, N. H., a search light, said to be the largest and highest in the world. Its elevation is 6,300 feet, and it is calculated to have 100,000 candle power. The current is 90 amperes and the voltage 56, and a French lens of 30 inches diameter is used, whereby it is calculated that a beam of light will be thrown by which a newspaper may be read at the Fabyan House, six miles distant. It is expected that every hotel within twenty miles of the summit can be illuminated by the search light, and that lawn parties and tennis tournaments in the evening will be added attractions at each.

Correspondence.

Electrical Transportation of Farm Products.

Mr. A. Jeffers writes that electricity is being used in the vicinity of Old Point Comfort to take the farm products—cabbages, potatoes, beans, peas, etc.—from the truck farms near Hampton to the government wharf for local consumption and for shipment north by steamer to New York, Philadelphia, Boston, Baltimore, or Washington. He also states that there are other lines near Norfolk contemplating the same thing. An electric motor placed on a flat car constitutes the locomotive, and other flat cars are attached which are loaded up to their full capacity.

How They Prevent Mosquitoes in Siam.

To the Editor of the Scientific American:

I saw in the April 16 number an article on "The Best Mosquito Remedy," and thought that those who have read it would be interested to know how we manage it here. The position of this section of the country is such that we cannot procure conveniently pure drinking water unless we collect the rain water in vessels during the rainy season, and that of sufficient quantity to last over to the next year. Ordinarily the rain water is kept in unglazed earthen jars of about 25 or 30 gallons each.

To prevent the mosquitoes from depositing eggs in the water, an iron nail is placed in each jar. For the first few days this will not prevent them, but after that time there will be no more mosquitoes or larvæ in the jars. To remedy this evil from the start, I heated the nails red hot, so as to produce oxide scales on the nails at once. A year ago I placed in every jar of rain water a couple of 5 inch wrought iron nails heated red hot. Several jars are now left over from then, and the water in them is as pure and free from mosquito larvæ as any one can wish.

The process described as above is not universally practiced now, but many years ago the ancient people did so during cholera time and cases of prevalent sickness, believing in the mysterious virtue of the iron nails to prevent harm and the mosquito larvæ from being in the drinking water. M. KAWN.

Bangkok, Siam, June 17, 1892.

Personal Recollections of Eminent Men.

BY DR. VANDER WEYDE.

Prof. Louis John Rudolph Agassiz, of Neuchatel, Switzerland.

The fifth decade of our century was made remarkable by the announcement that there had been a glacial period, when the whole earth was covered with a crust of ice, which in many localities had left its records by erratic, huge bowlders. Such bowlders, evidently, could only have been carried there from distant mountains by moving ice fields, such as glaciers. These glaciers, by their erosive action, had left also their marks on the rocks along which they had moved. These marks are abundantly found in many localities.

Charpentier was the first who, in 1840, published these facts, which soon attracted the attention of Agassiz, who at once went to study the details of the behavior of the glaciers in his native land. The result was that he not only accepted the idea of Charpentier that these glaciers had once covered the plains and valleys of the rivers Rhone and Aar; but he went further, and held that they had covered the whole of Europe north of Switzerland, and that even in South America glaciers had left similar records between the Andes and the Atlantic coast.

When, in 1846, he visited Scotland, he found also there undeniable evidences of glacial action, and announced his discovery to the Royal Society, of London, coming forward with the hypothesis that there had once been a period of intense cold over the whole surface of our earth, during which it became covered with a crust of ice, destroying the greater portion, if not all, of the vegetable and animal life then in existence.

No wonder that such a novel idea announced as a positive fact by such an eminent savant attracted universal attention, and the scientific journals of almost every enlightened country in Europe commenced to treat the subject. In this I took part by giving abridged translations in the Holland language of some of Agassiz's writings on the subject. I was induced to write on it by the request of editors of such journals under whose attentions I had been brought, upon receiving from Amsterdam, in 1845, a gold medal for a scientific prize essay.

I confined myself, however, strictly to an *exposé* of Agassiz's labors, without giving my opinion, reserving this until good luck might perhaps give me an opportunity to have a conversation with the eminent originator of this at once famous glacial theory.

In 1847 the newspapers announced that Prof. Agassiz had been appointed to the chair of geology and zoology in Cambridge, Mass., with a far more liberal salary than he obtained by his professorship in Switzerland. Of course he accepted this, also because it gave him an opportunity to study the North American continent in regard to his pet theory, the great glacial period.

About that time I commenced to prepare for a visit to the United States as a *reconnoissance*, to see how I would like it, and find out in how far I might succeed professionally. Additional attractions were the eminent men I would have an opportunity to meet, such as Prof. John William Draper, from whose excellent book on the influence of sunlight on plants I had translated and published some extracts, and who had made daguerreotypes immediately after the process had been published by the French government (after buying it from its inventor by a pension for life). As I also had been making daguerreotypes in Holland at the very same early period I was, of course, anxious to see a co-laborer in that field, which was so fascinating and inspiring during its first applications. There was Dr. Valentine Mott, who had visited Europe and extended his journey to Turkey to study leprosy in the country where it is indigenous. Then Dr. Hare, of Philadelphia, professor of the University of Pennsylvania, whose deflagrator I had constructed according to the published descriptions, and had added some improvements. Another was Prof. Henry, of the Smithsonian Institution, whose colossal electro-magnets, which he made while in Princeton College, I had imitated, with the improvements described by Pouillet in his "Elements de Physique," consisting in a colossal wooden frame containing two iron horseshoes of 100 pounds weight, each serving as the armature of the other and supporting, when charged, about a ton weight.*

There were other men whose reputation had crossed the Atlantic, but my desire to see the United States and some of its eminent men, of which the number was now increased by Professor Agassiz, was not fulfilled until two years later, when in 1849 I crossed the Atlantic.

On my arrival in New York I found at once that two scientific lectures were advertised to be given in the Tabernacle, then situated in Broadway, near Duane Street. Lectures were at that time very frequent and well attended, as then the few theaters had not yet absorbed so much of the public attention as they do now. A few years before an attempt had been made to introduce the ballet, but the spectacular additions of the present day had not been invented and the public taste appeared to be satisfied by attending lectures, concerts, quartet soirees for voices or stringed instruments, etc.

The first of the two lectures was very unsatisfactory to me, but the second, to be given by the great Agassiz, was excellent. He, however, did not treat the topic I expected and highly desired to hear him speak about, his glacial theory (about which I was of course most intensely concerned), but he treated a very different and interesting feature in the field of comparative anatomy, namely, the relative position of the great ganglion in the nervous system among the different classes of animals. He explained how in the oyster, which he considered as the very lowest type of intellect in the animal series, the great ganglion, the brain, was placed in its very lowest part, in a depression of the under shell; how in the clam and mussel, more intelligent than the oyster, this ganglion occupied a higher position; while in the snail, who could lift up her head outside the shell, there is added a far greater intelligence.

He explained how among the quadrupeds the lowest type, such as the pig, carried its head lower than the spine, that the ox carried it on a level, the horse had it higher. In the different grades of monkeys, the spine was no more horizontal, but inclined at an angle of 45 degrees, more or less, with the brain at the highest portion, while finally in man the spinal column was vertical with the brain on top. He concluded from this that, as the vertical position is the limit beyond which it is impossible to proceed, it is also impossible to imagine any further progress in this direction, and that therefore man must be the highest intellectual creature to be conceived, and beyond which there is no higher type possible.

After the lecture I introduced myself as a translator of some of his writings in the language of Holland, and as at that time I was not enough trained in the English pronunciation to express myself with ease, I asked him what language he preferred me to use —French or German. He answered, "Tout ce que vous voulez," and I continued the conversation in French, asking him if he still adhered to his opinion about the existence of a great glacial era once extending over the whole earth. He answered promptly, "Plus que jamais" (more than ever). I made the suggestion if there could perhaps not have been separate regions, which at different times became glacial, by an upheaval of only four miles above the surrounding level, as is now the case in the Alps, in the Andes, and in the Himalayas, where a glacial period is undoubtedly now in full operation, adding that such a temporary upheaval of the earth's crust, of three or four miles in altitude, is comparatively a mere trifle for a globe of 8,000 miles in diameter. I added hesitatingly that, according to this suggestion, it was not necessary to invent an additional theory to account for a catastrophe like a universal low temperature, such as that our earth and the whole planetary system had moved over very cold regions of the celestial space. But Prof. Agassiz answered promptly: "No; this catastrophe was only one of the many cataclysms of various kinds which preceded the creation of new species of plants and animals, and fossilized the existing ones. He added that this glacial period was perhaps the greatest of them all, and took place a short time (geologically speaking) before the appearance of the human race.

These were not his own words, as he expressed himself in elegant French, with an enthusiastic conviction which reminded me of the eloquence of Arago, whom I had once the advantage to hear lecture in Brussels, some ten years previously. I have, however, attempted to give a correct report of his meaning.

I ought to add that my boldness in differing with him in opinion had not the least influence in regard to his friendliness and kindness to me, when on suitable occasions I had some questions to ask him, such as, for instance, certain details in the osteology of ganoids, about which I heard him give a most masterly lecture. His desire to benefit others with what he had found out was a predominating trait in his character, and he did this with the greatest pleasure, sometimes not devoid of humor, shown in his eyes, which, in reality, at certain occasions had a laughing expression. For instance, when, during a session of the American Association in Boston, we were invited to an excursion by steamer outside the harbor and along the coast of Massachusetts, he was induced to talk about the enormous changes brought about by wave action on the shores during past geological ages. He stated, among other things, that the spot over which our steamer was sailing was once dry land. One of his lady hearers asked: "Professor, in what year was that the case?" He answered promptly, "Madam, that was before the Pilgrim Fathers came here." At the same time I caught his eyes, which were actually laughing when he winked; without that, his mouth showed no trace of his interior amusement.

I have, however, seen the opposite expression in those same eyes. On one occasion, a certain "Professor" Grimes, whose ignorance I had discovered by a previous private conversation, commenced reading a paper on geology, in which he exposed his own absurd theories. Very soon Professor Agassiz jumped from his seat, his eyes flashing with scorn and indignation. He said: "Gentlemen, have we come together here to listen to the ravings of a man who does not know the A B C of geology? I call on the president to maintain the dignity of our association." The motion was seconded almost by acclamation, and "Professor" Grimes was compelled to sit down. It was just time for recess, and Professor Agassiz, when passing me, said, in a laconic way: "That man will not trouble us any more."

On another occasion he was still more indignant. It was when he had been invited to accompany a gentleman who would conduct him to a place for seeing some "alleged new experiments." They were those of a spiritual medium. As soon as Professor Agassiz found what was going on, he was not only angry and indignant, but declared himself insulted by those who brought him to such a place, thinking that *he* (Agassiz) could be humbugged like the rest of them, and he left more angry than any one had ever seen him before.

* Those identical electro-magnets I brought with me when coming to reside in New York, and have on more than one occasion loaned them to Professor Doremus.

Miners' Wages in Hungary.

The daily wage of a regular hand at the Hungarian mines is only 32 cents to 40 cents, and of a temporary hand 28 cents. Boys are paid from 12 cents to 24 cents a day, and women from 12 cents to 20 cents. In the coal mines the wages are rather higher; men are paid from 48 cents to 60 cents a day, boys 20 cents to 28 cents, and women 18 cents to 20 cents. The wages in the iron mines are lower than those in coal mines, because the iron mines are all situated in populous districts where living is cheap. In all small mines tools and blasting materials are given free to the men, but in large mines the men have to pay the cost price of the blasting materials and lights. The low rate of wages is astounding to the American mind, but when the cost of living is taken into account, the lot of the Hungarian miners is by no means so bad as appears at first sight. For instance, a very comfortable house can be obtained for $2 a month. Three rooms, such as could be obtained in a tenement house here at $8 to $10 a month, cost 60 cents a month there, and an attic can be obtained there at 20 cents a month. Wood and coal can be had on easy terms and in many cases gratuitously. Food and supplies are exceedingly cheap, and many mine owners sell their hands food at next to cost price. In many of the State mines a deduction from the wages of ½ per cent is made for a music fund. All Hungarians are natural musicians, and Hungary is the home of true and unaffected music.

THE OTOCYON.

South Africa, that region which is so productive of strange and remarkable forms in the animal and vegetable kingdom, is also the home of the peculiar beast of prey shown in the accompanying engraving, taken from a drawing of that excellent delineator of animals, G. Mutzel. The scientific name for this animal is Otocyon caffer, or O. megalotis. Its enormous ears are what first attract the notice of spectators. No other beast of prey, with the exception of certain foxes, and we might add—if we except a number of bats—no mammal, has ears developed like those of the otocyon. What seems a necessity to the fox of the sandy desert that offers no shelter, as a means of perceiving the presence of some prey, or an approaching enemy that is hidden from his view by an irregularity in the surface of the ground or by darkness, and what is also indispensable to the nocturnal bat to aid him in catching his buzzing insect prey, seems, at the first glance, an extreme and exaggerated development in one of the canidæ. But if we look closely at the construction of the animal, keeping in mind his manner of life and the nature of his food, which is very different from that of the other canidæ, we will change our opinion. The teeth of the otocyon differ greatly from those of its relations, both in number and in the peculiar construction especially of the molars. They are much more like the teeth of insectivorous animals than like those of beasts of prey; and this solves the problem. The conclusions which we draw from the construction of the teeth are correct. The otocyon is to a great extent, if not exclusively, insectivorous, and as he prefers, after the fashion of his relatives, to hunt after sunset, a remarkably well developed hearing, by which he can perceive the slightest hum of the beetle or the buzz of the grasshopper, is of the greatest importance to him. The Englishman, Kirk, stated to the Zoological Society of London, in the sixties, that packs of these animals hunted large mammals, such as antelopes, etc., attacking even buffaloes. But Brehm has shown that this is highly improbable, and as we observe the delicate form of the creature, noticing also his teeth, we see that the above statement can hardly be correct.

Our picture shows the form and proportions of the otocyon excellently well. It is about the size of a small fox. The fur is gray spotted with yellow, the legs and the upper part of the tail being darker and the under part of the body somewhat lighter than the rest of the body. The home of our canidæ extends over South Africa, stretching pretty far north, but they are most numerous at the Cape and in Caffraria. The specimen in the Berlin Zoological Garden, from which our illustration was made, came from the German possessions in southwestern Africa and was a present from Hauptmann v. Francois.

Very little is known in regard to the history of the otocyon, from which we may conclude that these animals are not very numerous or are difficult to obtain. Very few specimens have been brought to the zoological gardens, of which studies could be made, and the subject of our illustration was, unfortunately, very short lived. Lack of proper food after a long sea voyage was probably the cause of its early death. As we stated above, our illustration was taken from the living animal, and is the first that was ever drawn by an artist, who has thus rendered an important service to science. We hope that, through the numerous friends and far-reaching connections of the garden, it may be possible to obtain a perfectly healthy specimen of this most peculiar of all the dog-like animals, so that closer observation may throw more light on its habits.—*Illustrirte Zeitung.*

THE OTOCYON.

A Modern Model Ranch.

BY H. C. HOVEY.

The term "ranch," derived from the Spanish "rancho," is capable of wide application. It fits the rude herdsman's hut amid the prickly pears and bunch grass, and also the magnificent country seat of a California millionaire. But it might properly be limited to the plantation where a farm house is surrounded by the huts of the peons, and where stock raising is carried on, combined it may be with orchards and general farming. Having expressed my wish to see such a ranch, in the hearing of gentleman at Las Vegas, an invitation followed to a dinner party at the Romero Ranch. A ride of five or six miles over a charming road brought us to the place. It is also accessible by a switch from the Santa Fé Railroad.

I had been told that the farm house was an "adobe," but the fact had not been mentioned that the adobe was covered with cement stucco, and that there were fine porticoes, observatories, a metallic roof, and hot and cold water throughout, and most other modern conveniences. From a large hall we were ushered into spacious parlors, five sets of sliding doors enabling our host to throw the whole lower floor into one large salon. Elegant furniture, well stocked libraries, a grand piano, and a most charming company of guests, were among our surprises. After dinner we were taken to see the model kennels, hennery, ice house, and the substantial two-story stone barn, carriage house, carpenter's shop, and other surroundings. There seemed to be a most thorough equipment of tools, machinery, and vehicles, among which we noticed a tally-ho coach.

This really princely mansion was originally built by Don Trinidad Romero, from whose hands it passed to the ownership of Arthur L. Cammell, Esq., of Derbyshire, England, and finally came into possession of the present owner, Mr. James H. Cravens, to whose hospitality we were indebted for a most enjoyable day. In reply to my inquiries, he told me that the ranch covered 2,664 acres, all under fence, and suitably divided into timber land, farm land, pastures, alfalfa fields, orchards, and gardens.

Having just attended an "irrigation convention," my curiosity was aroused as to the methods taken to water these extensive grounds. There are two artificial lakes, each holding about one million gallons, and supplied by an acequia from the Gallinas River. Two other and smaller lakes are fed by perpetual springs flowing from a small canyon amid the hills. Marvelous crops are reported as raised by means of this efficient irrigation. Mr. Cravens assured me that the yield from the orchard alone, in 1891, was at the rate of $800 per acre. Four crops of alfalfa are cut annually. It should be added, however, that only 350 acres are in actual cultivation, of which 275 acres are in alfalfa.

After a stroll through an adjoining Mexican village, with its quaint adobe huts and its contented people—too contented indeed for their best welfare—Mr. Cravens exhibited, for my amusement, the paces of a fine black mare, of which he was very proud. After showing the trotting, running, and leaping powers of the creature, he asked me if I thought my Kodak could catch her in the act of leaping a bar. Setting my tripod, getting the bar fairly within the field, fixing my shutter at the hundredth of a second, I succeeded in taking a photograph of "Hermosa" and her rider in mid-air that looked as if they had just been struck by lightning. My faithful Kodak was next turned toward the mansion itself, with a more clear result, though hardly more gratifying.

While the Romero Ranch excels most of the New Mexican homes, the fact should be noted that, as far as I was concerned, it was selected at random from a number that I had thought of visiting, and the foregoing description is published for the information of the public about a region that is generally regarded as "arid," and held only by beings half civilized. The tourist who hurries over the broad plains, and whirls across the mountain passes, gets no adequate idea of the imperial domain that is being gradually brought up to the dignity of a great American commonwealth, worthy of an honored place in the sisterhood of the United States.

A NEW process of warping and beaming has been inaugurated at Westfield, Mass., by the building of a machine which takes the yarn direct from the cop or bobbin and winds it upon the ⅜ inch skewer, entirely dispensing with the spools now used in creels for warping. By winding on the skewer direct the space occupied by the heads and barrel of the spool is entirely used for yarn, thus making a great gain in quantity, reducing waste, and enabling one tube of this yarn to make two warps with one tying in, thus securing great saving in time.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR COUPLING.—William H. Harris, Newberry, S. C. This invention relates particularly to twin jaw couplers, the device provided being very simple, and having but few parts, while one of the jaws automatically and safely locks to effect a coupling. The drawhead has a central cavity and side recess, and the coupling jaw has a coupling and locking arm, and when two cars are brought together, the coupling arm of one car contacts with the locking arm of the opposite car. The uncoupling is effected by rocking a shaft journaled at the end of the car, whereby a pivoted catch block is raised, and may be fixed in elevated position if desired.

CABLE TRACTION SYSTEM.—George Muller, Hoboken, N. J. This is an improvement on a former patented invention of the same inventor, providing a system which permits the employment of two cables for each track and reducing the friction to a minimum, the picked up or dropped cable not coming in contact with the other one. The invention consists principally of two sets of pulleys arranged on opposite sides of the cables on an S or similar curve, each set of pulleys comprising two pulleys, one for each cable, and mounted to turn in a yoke adapted to swing.

CABLE RAILWAY CURVE.—The same inventor has likewise obtained a patent relating to cable traction with a duplex cable system as applicable to its use on curves of the roadbed, the improvement providing for the convenient use of either cable on a curve without one cable interfering or coming in contact with the other. Two sets of supporting devices are arranged on opposite sides of the cables to pass one cable over and above the other, and, with two cables entering the curve one above the other, a device is provided for passing and guiding and crossing the lower cable over and above the other, so that on leaving the curve the position of the cables is reversed.

RAIL JOINT.—George G. Stacy, New York City. This invention relates to a former patented invention of the same inventor, providing a cheap, strong and simple joint, which may be easily applied to the meeting ends of rails to hold them so that they cannot move longthwise or sideways. It consists of angle plates whose vertical portions fit the rail webs, and with outwardly extending notched base flanges, in connection with a base plate to receive the rails and having uprights fitting the notches, the uprights having side arms overlapping the flanges. The joint is a very strong one, practically making the rails continuous.

Electrical.

ELECTRIC RAILWAY TROLLEY AND CONDUITS.—Wilton F. Jenkins, Richmond, Va. Three patents have been granted this inventor relating to railways having underground electric conduits. Within a conduit carrying two conductors or circuit wires, one carrying current to the motor and the other returning it therefrom, means are provided for separating or insulating from each other the wheels or rollers that travel upon the conductors, together with means for insuring a steady and constant contact between the trolley wheels and the conductor, the trolley being loosely connected to the car. One of the patents also provides means for adjusting the trolley to the car in such manner as to permit the connection to be readily made, a drag connection being provided for the trolley which may be reversed without disconnection from the car, while vertical and lateral vibration between the car and trolley will be taken up. Another of these inventions provides a novel construction of the body of the conduit and means for holding the conductors in proper insulated position. The tubular conduit has a continuous longitudinal slot on its upper side and transverse external re-enforcing ribs, terminating externally some distance from the slot and reappearing internally, while adjustable slot plates are applied to vary the width of the slot.

Mechanical.

DIE PLATE.—Lewis C. Wetzel, Bellefonte, Pa. This invention provides a very effective implement, of durable construction, by means of which the desired sized die may be conveniently brought into the proper position for immediate use, a series of different sized cutters being provided in the same tool, while the die stock can be readily opened after the thread is cut to disengage the dies from the threaded bolt.

FLOOR JACK.—Edward A. Bullock, Bellefonte, Pa. This is an implement which may be readily shifted from one joist to another, its grip portion being adjustable to fit joists of varying thickness. It is designed to be quickly and conveniently operated to force the tongue of one floor board into the groove of the next board, making a perfect joint between the two boards, while the last board laid is nailed to place. Its construction is very simple, and one person may operate the device and nail the board to the place in which it is held by the jack.

MATCH AND TOOTHPICK MACHINE.—Joseph Boulard, Newport, R. I. Blocks of wood fed to the machine designed by this inventor are rapidly cut into toothpicks or matches, according as the machine may be adjusted for one or the other kind of work. The machine will also point the splints, deliver them into a carrier, dry them thoroughly, and finally deposit them in a suitable receptacle. In the making of matches it dips the splints in the baths, so that a finished article is made by the machine.

WELL DRILLING MACHINE.—James W. Draper, Frederick Draper and Walter Ellsworth, Alden, Iowa. This is a simple and durable machine of improved construction, designed to be very effective, and to be operated at a high rate of speed. The main driving shaft, journaled in the base of the derrick, imparts motion to a walking beam, by means of which the drilling tools are lifted and dropped, the amount of lift and drop of the tools being conveniently regulated by adjusting clamps on the beam.

POLISHING WHEEL.—John McClellan, Greenbush, N. Y. A wheel designed for conveniently polishing marble and other material is provided by this invention. The wheel is attached to an ordinary polishing machine, and the invention consists of an inverted revoluble cup, adapted to contain the grinding material, an adjustable ring on the rim of the cup holding the material in place and preventing the cup from striking the marble.

MECHANICAL MOVEMENT.—Felix Meny, Elizabeth, N. J. Two rock shafts are, according to this invention, controlled from a reciprocating crosshead, provided with slotted arms, or drivers, one delivering the crank pin to the other, to carry it around a half revolution. The reciprocating crosshead has pivoted wings engaging the crank arms of the rock shafts, and adapted to be locked in place, the improvement being designed to facilitate converting reciprocating into rotary motion effectively and uniformly, avoiding dead centers.

Agricultural.

HARVESTER.—Jacob T. Mider, Wathena, Kansas. This invention relates more particularly to harvesters in which the heading and thrashing of the grain is effected as the machine travels over the field, the machine heading, thrashing and separating the grain in a simple, rapid and economical manner. The parts of the machine are so arranged that the several operations are carried on continuously, without wasting, and detachable bins are provided whereby the grain may be gathered in bins ready for shipment.

HAY STACK CUTTER.—John T. Evans and Joseph H. Douglass, Adamsville, Utah. A machine which may be placed above the stack or over piles of hay to be operated upon is provided by this invention. The machine is adapted to be operated by hand, and carried across the stack or stopped at any desired point, for cutting out large or small sections of hay for baling or shipping purposes, or for being fed to cattle and stock. Upon a bed vertically adjustable upon trestles is a traveling carriage, carrying a vertically reciprocating crosshead, to which is secured a knife projecting below the bed, means being provided to simultaneously move the carriage and reciprocate the crosshead.

Miscellaneous.

SELF-RECORDING PLANOGRAPH.—Justo Soler (deceased), Yanko, Porto Rico, W. I. (Perry B. Turpin, administrator). This machine is mounted on three wheels, and adapted to be moved over the ground by hand, a strip or ribbon of paper and a pencil being used to make horizontal angles, lines or curves, and another pencil being used to mark elevations or depressions. The paper is caused to travel under the pencil at a speed bearing a known relation to the diameter of one of the main wheels, thus affording a scale for reading the scroll made by the pencils, which form a figure on the paper similar to the ground measured.

EYEGLASSES.—Adolph H. Hartmann, Brooklyn, N. Y. An attachment for glasses is provided by this invention, to hold the glasses in proper position before the eyes, and prevent them from dropping downward or slipping out of place. It is so made as to conveniently accommodate itself to any shape of nose, and the device may be attached to glasses of any description. It consists of bracket-like strips detachably secured to the frame, each strip having a vertical portion and a foot section, the strips forming auxiliary clamps to engage the nose.

CAUSTIC ALKALIES AND CHLORINE.—Farnham M. Lyte, London, England. This invention provides a conjoint process of continuously producing caustic alkali and chlorine by decomposing an alkaline nitrate by heating it with ferric oxide to evolve nitrous fumes, decomposing the residue by boiling with water into caustic alkali free from iron and a precipitate of ferric hydrate, converting the nitrous fumes into aqueous nitric acid, dissolving plumbic oxide therein, precipitating plumbic chloride, fusing it and decomposing it electrolytically into chlorine and metallic lead, and finally converting the lead into plumbic oxide and the ferric hydrate into ferric oxide, for recommencing the cycle.

LIFE SAVING AND PLEASURE CRAFT.—Arthur B. Shearer, Reno, Nevada. Three separate and distinct boats, connected together and propelled by an electric motor, forms the distinctive feature of this invention. Each boat has a copper bottom, an air and water tight cover for its deck, is divided into compartments, and has a motor which may be operated from the shore or from the deck of the vessel. The boats are joined together with strong braces, covered with steel mesh as a platform for passengers, and here are seats with straps buckled across them, while there are suspended knotted ropes to enable persons in the water to pull themselves upon the craft.

NUT LOCK.—Axel Warenskjold, San Diego, Cal. This is a safety nut for wagon axles, bolts, etc., and is of very simple and durable construction, readily applied, and very effective. It is longitudinally and internally grooved, and has a longitudinally sliding spring-pressed key crossing its bore, the spring pressing the key toward that end of the bore which receives the bolt. The spring and the key are always in position in the nut so that they cannot be lost, and the nut is always ready to be attached.

HARNESS TUG.—Samuel P. Chandler, Lake City, S. C. This is a thill tug, comprising a yielding loop portion, having rigid end sections arranged to be interlocked and detachably connected, so that they may be readily separated to allow of the unhitching of the horse from the shafts. The device is simple, inexpensive and very efficient.

VEHICLE BRAKE.—Ernest W. Broadhead, Dolores, Col. This brake is designed to be comparatively noiseless, the construction being such that the brake shoes will be normally out of engagement with the wheels. A shaft journaled under the vehicle, and having crank arms carrying the brake shoes, has an upwardly extending arm connected by a link with a foot lever, while a spring around the shaft, having one end secured to an adjustable collar and the other end to the shaft bearing, keeps an even tension upon all the joints of the brake.

VELOCIPEDE.—Abram C. Shelley, Blythebourne, N. Y. A machine especially adapted for traveling upon water is provided by this invention, its construction also admitting of its quick and easy adjustment for use upon land. The wheels are formed in two sections, one adjustable toward the other, the sections being connected by detachable floats with stiff heads and flexible bodies, and removable paddles being held in the wheels. The machine is designed to ride upon the waves and not plow or sink into them, and combines economy of construction with lightness and strength.

DOOR SPRING.—John A. Cooper, Nashville, Tenn. The spring proper, according to this invention, has a terminal portion or limb at its fast end, adapted to engage in removable manner with fixed holders or staples, a socket or shank piece entering in and engaging the opposite or free end, while a removable wrench, adapted to engage the shank piece, forms a part of the spring fixture. The improvement forms an attachment for convenient application to light or heavy doors, gates, etc., the spring being readily tightened or loosened, or taken off and reversed as desired, without the aid of special tools.

HOLDER OR RACK.—Charles Worden, Rye, N. Y. This is a device more especially designed for conveniently holding brooms, billiard cues, and similar handled articles, automatically clamping the handles and permitting the ready removal of the articles when desired. The device has a series of vertical ribs between which the handle is passed, and a roller travels in a recess in the inner side of one of the ribs, the bottom of the recess being inclined outward and upward from near the lower end of the rib. The article is thus held suspended, and the greater its downward pull, the tighter will the roller press against it to sustain it.

INKSTAND.—Liston B. Manley, Duluth, Minn. This is an improvement on a former patented invention of the same inventor, the inkstand being rendered more simple and more easily manipulated, while being more readily attached to a desk and occupying less room. A standard to be attached to a desk forms a swing support for the entire stand, and the sockets receiving the ink wells are so connected with the adjustable arm that when the arm is carried upward the ink wells will always maintain a horizontal position, the ink wells being movable laterally as well as vertically.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(4516) J. B. B. asks: 1. Does a boat run faster when she is loaded by the head or stern is a question under discussion. One claim is that when loaded by the head the position of the boat makes her run down hill, and when loaded by the stern she has to run up hill. Others claim that if loaded by the stern she is made to float higher and requires less displacement, and if loaded by the head she is forced down into the water. A. Boats for speed as built after modern practice have their lines formed for the greatest speed or least resistance on a specified water line, with their keels generally sloping to a greater draught near the stern. Loading by the stern or head interferes with the speed by changing the form of the immersion lines. In sailing craft loading by the stern is required to a certain amount to counteract the tendency to dip the stem by the action of the wind on the sails.

(4517) W. H. B. asks: 1. Is lead or iron ballast better for a sailing yacht than stone? If so, has it been proved? A. Lead or iron is the best ballast for sail yachts, because of its density allowing a given weight to lie closer to the keel and thereby give greater stability to the vessel. 2. What would it cost to build a steam yacht 12 feet keel? Will a cylinder 2×3 inches drive the boat at a fair speed? A. Do not know the cost. The 2x3 inch cylinder will run the 12 foot boat at a fair speed. 3. Do you illustrate all the new war ships launched? A. We have illustrated many of the new war ships of the United States Navy.

(4518) L. L. H. says: We have a 1½ inch pipe laid from our factory to a river, which is 47 rods away and is about 26 feet lower than the factory. The pipe enters a bank as it nears the factory and runs into a large well 12 feet below the surface of the ground. The well is 26 feet deep and the pipe turns from where it enters the well and goes to the bottom, then turns up again in a U form to a height of 6 feet. Here we have a Vandusen steam jet pump which drew the water from the river for about three or four months after it was first laid, but since then has given us considerable trouble. I would like to know if you think a piston pump would

work any better than the jet. We use the city water works for cleaning out the pipe when it gets dirty. There are no elbows in the pipe except where it turns down in the well; all other turns were made by bending the pipe. Do you know of any way that we can convey power to the river, such as compressed air or some other way, by which we can force the water up to factory without too much outlay? A. The obstruction in the pipe that prevents the jet pump from working satisfactorily, would also interfere with the action of a pump. If the pipe is of wrought iron, not galvanized, it is liable to rust and form nodules on the inner surface throughout its length, which decreases the area and increases the friction. By raising the pipe at the river end and connecting with the water works pipe at the factory end, giving the full pressure on the pipe would show by the stream at the river end whether the pipe is permanently obstructed. If found to be obstructed, the pipe should be taken up and cleaned by pushing a smaller pipe through with a sharpened coupling on the end, a little smaller than the bore of the 1¼ inch pipe. If there should be a full, strong flow from the pipe, the next possibility will be air leaks. To ascertain the fact, arrange the steam jet so as to discharge from an open pipe and start the jet. If there is air in the pipe or air leaks, the discharge will sputter, or become intermittent, possibly stop altogether. This is supposing that the start is made with the pipe fully charged with water. There is also a possibility that the separation of the air from the water by the partial vacuum in the siphon suction pipe may cause some trouble by accumulating at the apex and separating the water in the pipe. By your statement, your siphon has a probable lift of 26 feet or nearly its limit, and it may be that this is the source of your trouble. You can transmit power to drive a pipe pump by a wire rope system from a pulley in the factory to a pulley at the river with a couple of supporting pulleys at proper distances to keep the wire rope from vibrating.

(4519) G. J. asks: 1. Is there in existence a perfectly working long-distance pneumatic tube system? A. No; probably a mile or less. 2. What is the longest electric railway in existence? A. 5 or 6 miles. 3. What are the prospects of a near adoption of electricity on the steam railroads? A. The prospect is very distant. The system of wiring would be too intricate for the immense traffic and yard switching of our great railways.

(4520) Reader writes: Some years ago I saw at this place an exhibition wherein apparitions were made to appear on the stage by what was said to be the manipulation of mirrors under the stage of the theater. A form of a woman would appear, first in a transparent mist, and then would assume a perfectly lifelike appearance. A. The illusion to which you refer is produced by a plate glass mirror erected upon the stage at such an angle as to reflect the image of the figure below the front of the stage, a strong light being thrown upon the figure. This illusion is known as "Pepper's Ghost."

(4521) W. G. S. asks: For bathing purposes is artesian well water healthful or unhealthy? A. Artesian well water is healthy for bathing as much so as for household purposes. The wells that furnish hard water do not afford the satisfaction to bathers as the soft water wells. A little ammonia in the hard water makes a satisfactory and healthy bath. The mineral constituents of the hard water from artesian wells are principally lime and magnesia, with their various combinations. Some wells furnish water of decided sanitary properties.

(4522) E. G. A.—The following is a receipt for herb beer: Pour boiling water on 2½ ounces sassafras; 1½ ounce wild cherry bark; 2½ ounces allspice; 2½ ounces wintergreen bark; ½ ounce hops; ½ ounce coriander seed; 2 gallons molasses. Let the mixture stand 1 day. Strain, add 1 pint yeast, enough water to make 15 gallons. This beer may be bottled the following day.

(4523) C. C. asks how to harden a chisel for chipping casehardened iron. A. Heat the chisel after sharpening to a low cherry red and then plunge it in a saturated solution of chloride of zinc. The chisel must be rehardened whenever it is sharpened.

(4524) F. S. B. writes: 1. It is said that if balls of wax and lead are dropped from the top of a building, they will fall together. Do you think this is wrong? A. There would be a difference, but it would be almost imperceptible. In a vacuum, both bodies would fall in the same time. 2. How do scientists explain that capillary attraction is not a case of work being done without an apparent loss of energy? A. In rising in a moisted tube water obeys the force of cohesion exercised over space, which represents the expenditure of energy. To extract the water from the tube, an exact equivalent of work would have to be done. Potential energy is represented by the separation of the water in mass from the water wetting the walls of the tube, or by the separation of the water in mass from the dry walls of the tube, if we assume a dry tube to be used, and adhesion to be one of the actuating forces.

(4525) W. E. P. asks: How should the 8-light dynamo be connected for the best results, when used for charging storage batteries, and how many will it fill; batteries to be connected in series, and using a 1-horse power Shipman engine for power? Dynamo is now connected as shown in Fig. 1 (large cut) in SUPPLEMENT 600. A. The 8-light dynamo should be connected in series for use in charging storage cells. You should connect your cells in series. The dynamo will charge from 10 to 20 cells. The rapidity of charging diminishes with the increase in the number.

(4526) J. M. writes: 1. Please give some antiseptics for a gelatine emulsion for dry plates? A. SUPPLEMENT No. 541 contains full instructions for making emulsons. 2. Where may the wooden valves used in the air pump, Experimental Science, p. 92, be bought? A. These valves are not on sale. They are easily made, and with very little effort you can make them yourself. 3. How could the motor, on p. 498 of the same book, be best converted into a dynamo, and what would be the power of the same? Also name books containing instructions for making simple dynamos, without the need of lathes or special tools. A. Make the field magnets of cast iron, and wind the field magnet and armature with No. 20 or No. 22 wire. 4. I have a lantern which is identical with the one described on p. 394, but have not changed it in any way. It shows colored slides quite well, but will not show a good picture off a photo. slide. How could I change it? A. Modify the lantern in the manner described in Experimental Science, that is to say, replace the front lens of the objective with a meniscus of the same focus.

(4527) J. F. R. asks: Is it safe to fasten a lightning rod to a wooden house with staples, without insulator glasses? A. Yes.

(4528) W. C. Moore writes: I inclose, you will find, a leaf of a plant found in west North Carolina the natives call "gall of the earth" or "rattlesnake's king," the milk white juice of which is said to be an immediate and sure cure for rattlesnake bites. I have made some notes on the subject. So please let me know if it is generally known to the scientific world, and what its analysis is, and I will be pleased to furnish you specimens and what information I can procure. Answer by Prof. C. V. Riley: The leaf accompanying Mr. Moore's letter is what is known as rattlesnake root, *Prenanthes altissima*, Hook. It is referred in the botanies to the genus Nabalus, and is popularly known as white lettuce, rattlesnake root, etc. There may be some foundation for the belief your correspondent refers to, and the common name of the plants of the genus would indicate such a property. I cannot find, however, any authorities which accord to it this power of curing rattlesnake bites. It is used as an astringent in dysentery, and an analysis of the plant which has been made indicates that it contains tannin and various inert properties.

(4529) G. C. H. writes: I send you by mail to-day, under a separate cover, two bullets which were picked out of the snow after a target shoot February 22. The projectiles were fired from the best breech loading target rifles with heavy charges of powder, and, after flight of (200) two hundred yards, passed through a paper target backed by one thickness of cotton cloth (sheeting), then entered the snow, penetrating but a few inches, and were picked up with the points marked as you now see them. The feature to which I specially desire to call your attention is this peculiar marking upon the point. It is a reproduction of the surface of the cloth, in which you can trace every thread of the fabric. It is possible that the tremendous velocity of the bullet made the impact equivalent to the blow upon a stationary and immovable object, or that a small piece of the cloth may have been punched out, and, going forward with the bullet, was impressed between the bullet and the snow. The matter may be sufficiently interesting for you to express an opinion upon. A. Your first explanation appears reasonable.

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Wrapper, J. J. Cochran ... 481,849
Wrench. See Carriage wrench. Ratchet wrench.
Yoke, neck, L. W. Rothrock ... 481,825

DESIGNS.

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Button, campaign, W. S. How ... 21,815
Car body, railway, Stohl & Gallagher ... 21,824
Carpet, J. C. Chamberlain ... 21,829
Cloak, A. Popkin ... 21,828
Handle for cutlery, etc., W. W. Hayden ... 21,809 to [illegible]
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Lamp standard, A. Koehn ... 21,820
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Padlock case, E. A. Judd ... 21,821
Pistol cheek, J. H. Wesson ... 21,822
Pistol cheek, D. B. & J. H. Wesson ... 21,823
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Stove board, A. Lehnhardt ... 21,806
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Table, S. Nuttall ... 21,808
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